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Verification Report

S.C. Hidroelectrica S.A.

First Periodic Verification of the JI Track 1 Project

“Modernisation of 3 hydro units in Portile de Fier I hydro station”

Monitoring period: 01-01-2008 to 31-12-2011

Report No. 600500936

14 November 2012

TÜV SÜD Industrie Service GmbH
Carbon Management Service
Westendstrasse 199 - 80686 Munich - GERMANY

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Subject:			First Periodic Verification of the JI Track 1 project "Modernisation of 3 hydro units in Portile de Fier I hydro station"	
Executing Operational Unit:				
TÜV SÜD Industrie Service GmbH, Carbon Management Service Westendstrasse 199 - 80686 Munich, Federal Republic of Germany				
Project Participants involved in the JI activity:				
S.C. Hidroelectrica S.A. (project owner and client) Str. Constantin Nacu, Nr. 3, Sector 2 Ro – 020995 Bucuresti Romania **SenterNovem** Juliana van Stolberglaan 3 2595 CA The Hague, The Netherlands (now part of **Agentschap NL)** NL Energie& Klimaat Croeselaan 15 3521 BJ Utrecht, The Netherlands				
Registration number / Project Title			Registered as RO1000203 on: http://ji.unfccc.int/JIITLProject/DB/WEHGEYD0X1P72IE407L7WIBVBTFUCB/details	
Monitoring period:			01-01-2008 to 31-12-2011	
First Monitoring Report (version/date)			Version 1.0 / 20-02-2012	
Final Monitoring Report (version/date)			Version 4.0 / 05-11-2012	

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Summary:
The Certification Body "climate and energy" of TÜV SÜD Industrie Service GmbH has been ordered by S.C. Hidroelectrica S.A to carry out the first periodic verification of the registered JI Track-1 project "Modernisation of 3 hydro units in Portile de Fier I hydro station".
The verification is based on requirements of the UN Framework Convention on Climate Change (UNFCCC) and the host country specific requirements. In this context, the specific guidance from the Designated Focal Point (host country) in his responsibility for the approval of JI track 1 projects, relevant provisions set by the Marrakech Accords, the Kyoto Protocol and the JI-SC (Supervisory Committee) for JI Track-2 projects have been taken into consideration. The verification of this JI project has been performed by document review, interviews by e-mail and inspection on-site.
The verifier confirms that the project is implemented as planned and described in re-determined project design documents (TÜV SÜD Determination Report No. 1068445a, Revision 2, determination date 21-11-2008), Monitoring Plan rev. 2, dated March 2008 with Annexes 5, 6 and 7 and the Baseline Study performed by KPMG in July 2002. Installed equipment being essential for generating emission reduction runs reliably and is calibrated appropriately. The monitoring system is in place and the project does generate GHG emission reductions. The verifier confirms also that the monitoring plan of the project activity is in accordance with the applied methodology. The management of S.C. Hidroelectrica S.A. is responsible for the preparation of the GHG emissions data and the reported GHG emissions reductions on the basis set out within the Monitoring Plan rev. 2, dated March 2008 with Annexes 5, 6 and 7.
The verifier can confirm that the GHG emission reduction for the entire monitoring period is calculated without material misstatements. Our opinion relates to the project's GHG emissions and resulting GHG emissions reductions reported and related to the valid project baseline and monitoring plan, and further associated documents. The emission reductions calculated for this monitoring period are significantly lower than the values indicated in the Monitoring Plan rev. 2, dated March 2008.

Based on the information received and evaluated we confirm the following statement:

Reporting period: from 01/01/2008 to 31/12/2011

Verified Emission Reduction in the above reporting period:

2008: 169,711 t CO_2e (leakage and project emissions are 0)
2009: 154,135 t CO_2e (leakage and project emissions are 0)
2010: 168,791 t CO_2e (leakage and project emissions are 0)
2011: 92,087 t CO_2e (leakage and project emissions are 0)

Total Emission reductions: **584,724** t CO_2e.

Assessment Team Leader: Robert Mitterwallner **Assessment Team Members:** Georgios Agrafiotis Constantin Zaharia	**Technical reviewer :** Olena Maslova, Karin Wagner **Certification Body responsible:** Thomas Kleiser

Abbreviations

ACM	Approved Consolidated Methodology
AIE	Accredited Independent Entity
BM	Build Margin
CAR	Corrective Action Request
CM	Combined Margin
CMP	Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol
CO_{2e}	Carbon dioxide equivalent
CAR	Corrective action request
CR	Clarification Request
DFP	Designated Focal Point
EF	Emission Factor
EIA / EA	Environmental Impact Assessment / Environmental Assessment
ER	Emission Reduction
EUR	Emission Reduction Units
FAR	Forward Action Request
FSR	Feasibility Study Report
GHG	Greenhouse Gas(es)
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
IRL	Information Reference List
JI	Joint Implementation
KP	Kyoto Protocol
MP	Monitoring Plan
MR	Monitoring Report
NGO	Non-Governmental Organisation
OM	Operational Margin
PDD	Project Design Document
PP	Project Participant
QA/QC	Quality assurance/quality control
TÜV SÜD	TÜV SÜD Industrie Service GmbH
UNFCCC	United Nations Framework Convention on Climate Change
DVM	Determination and Verification Manual, Annex 4 of JISC 19 report

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Main Documents (referred to in this report)

Methodology (name / version)	Project specific, JI track 1	
Scope	1	
Technical Area	1.2	
Determinated Report: Baseline Study:	TÜV SÜD Determination Report No. 1068445a, Revision 2, dated 21-11-2008 KPMG, 2002	
Monitoring Plan:	11-07-2008, aproved by Romanian DFP in December 2010	
	Version	Date
Published Monitoring Report	1.0	22-02-2012
Revised Monitoring Report	4.0	05-11-2012
Project documentation link:	http://ji.unfccc.int/JIITLProject/DB/WEHGEYD0X1P72IE407L7WIBVBTFUCB/details	

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1 INTRODUCTION

1.1 OBJECTIVE

S.C. Hidroelectrica S.A. has commissioned an independent verification by TÜV SÜD Industrie Service GmbH (TÜV SÜD) of its determined JI track 1 project "Modernisation of 3 hydro units in Portile de Fier I hydrostation".

The objective of the periodic verification is to verify that actual monitoring systems and procedures are in compliance with the monitoring systems and procedures described in the monitoring plan for the respective period. Furthermore, the periodic verification evaluates the GHG emission reduction data and expresses a conclusion with a high, but not absolute, level of assurance about whether the reported GHG emission reduction data is free of material misstatements and verifies that the reported GHG emission data is sufficiently supported by evidence, i.e. monitoring records.
The verification shall consider both quantitative and qualitative information on emission reductions. Quantitative data comprises the monitoring reports submitted to the verifier by the project entity. Qualitative data comprises information on internal management controls, calculation procedures, and procedures for transfer, frequency of emissions reports, review and internal audit of calculations/data transfers.
The verification work ensures that the project activity is assessed against all applicable JI Track-1 requirements in the host country as specified by the Designated Focal Point (DFP) for JI/CDM project implementation in Romania. The JI requirements as reference include also the JI modalities and procedures and subsequent decisions by the COP/MOP and documents released by the JI-SC and available on the UNFCCC JI website http://ji.unfccc.int/index.html.
The objective of the verification work ensures that the project activity complies with the requirements as specified in the appendix B of the JI guidelines on the aforementioned UNFCCC JI website http://unfccc.int/resource/docs/2005/cmp1/eng/08a02.pdf#page=2. These guidelines are considered valid for JI Track-2 as also for JI Track-1. According to this assessment TÜV SÜD should:

- Ensure that the project activity has been implemented and operated as per the registered MP and that all physical features (technology, project equipment, monitoring and metering equipment) of the project are in place;
- Ensure that the published MR and other supporting documents provided are complete and verifiable and in accordance with applicable JI Track-1 requirements in the host country;
- Ensure that actual monitoring systems and procedures comply with the monitoring systems and procedures described in the monitoring plan and the applicable approved methodology;
- Evaluate the data recorded and stored as per the methodology of approved MP;
- Evaluate the GHG emission reduction data and express a conclusion about whether the reported GHG emission reduction data is verifiable and sufficiently supported by evidence, i.e. monitoring records

1.2 SCOPE

The verification scope encompasses an independent and objective review and ex-post determination of the monitored reductions in GHG emissions by the Accredited Independent Entity.

The verification is based on the submitted monitoring report, the determined project design documents including its monitoring plan approved by the Romanian DFP and the baseline study; the applied monitoring methodology, relevant decisions, clarifications and guidance from the CMP and the JISC and any other information, references and national regulations relevant to the project activity's resulting emission reductions. These documents are reviewed against the requirements of the Kyoto Protocol, the JI Modalities and Procedures and related rules and guidance as well as against requirements as described in the Romanian National Guidelines and Procedures for JI Track 1 projects.

Based on the requirements in the JI DVM, TÜV SÜD has applied a rule-based approach for the verification of the project. The principles of accuracy, completeness, relevance, reliability and credibility were combined with a conservative approach to establish a traceable and transparent verification opinion.
The verification considers both quantitative and qualitative information on emission reductions.
The verification is not meant to provide any consultancy towards the client. However, stated requests for clarifications, corrective and/or forward actions may provide input for improvement of the monitoring activities.

The project was finally approved by the Designated Focal Point for JI/CDM project implementation in the Romania on 24.12.2010 and has the reference number RO-1000203. Relevant associated documents are published on the Romanian web page at: http://www.mmediu.ro/protectia_mediului/schimbari_climatice/5_Proiecte_JI/SITUATIA-PROIECTELOR-JI-LoE-SI-LoA.pdf

1.3 GHG PROJECT DESCRIPTION

Project activity:	"Modernisation of 3 hydro units in Portile de Fier I hydrostation"
DFP registration number:	**RO1000203**
UNFCCC link:	http://ji.unfccc.int/JIITLProject/DB/WEHGEYD0X1P72IE407L7WIBVBTFUCB/details
Project Participants:	S.C. Hidroelectrica S.A. (project owner) SenterNovem (now : Agentschap NL)
Location of the project:	Drobeta Turnu Severin, Romania, N: 44° 21' , E: 22° 31' (Latitude 44.35°, Longitude 22.51°)
Date of registration as track 1:	24-12-2010
Starting date of the crediting period:	01-01-2008

The purpose of this project is to generate additional electricity at the refurbished turbine-generator units on the Portile de Fier I Hydro Station (in the following: PdF I) in Romania and supply the generated electricity in to the public grid. The PdFI hydro power plant is situated at Km 942 + 950 on the river Danube near the city of Drobeta Turnu Severin, Romania. The initial hydro power project Portile de Fier I was developed and implemented by the Romanian and Yugoslavian authorities and became operational in 1971. The whole power plant complex is managed by the joint Serbian-Romanian commission. It consists of 2 identical parts, 6 turbine units on the Serbian side and 6 units on the Romanian side, each with a rated capacity of 175 MW.
The 6 turbine-generator units on the Portile de Fier I hydro power station were refurbished from the initial 175 MW rated capacity up to 194.5 MW rated capacity. The works have been implemented by VA TECH HYDRO Ltd. and consisted of the replacement of the turbine blades.

The present JI track 1 project activity covers only the additional electricity generation at the refurbished three turbine-generator units on the Portile de Fier I hydro power station, HG 1, HG 2, HG 3.
The implementation status of the project in the verification period is as follows (see also table below):

- Replacement of turbine blades in units HG1, HG2, HG3, increase of installed turbine capacity (19.5 MW for each turbine) and increase of turbine efficiency (up to 1%)
- Increased electricity generation by the refurbished turbine-generator units
- Supply of the total generated electricity in to the public grid

Turbine Unit	Commissioning of the refurbished Turbine Unit
HG 1	30-03-2007
HG 2	22-10-2004
HG 3	05-09-2003

2 METHODOLOGY

2.1 VERIFICATION PROCESS

The verification process is based on the approach depicted in JI guidelines and, in particular, refer to the Guidance on Criteria for baseline setting and monitoring, chapter C. – Guidance on monitoring. Accordingly relevant requirements as set by the JI-SC for JI Track-2 are applied for JI Track-1 as long as there are no further host country requirements existing (and indicated in the national regulations and procedures) specifically for JI Track 1 projects. Following the good monitoring practices and its reporting the approved Joint Implementation Determination and Verification Manual (DVM) was also taken into consideration.
Standard auditing techniques have been adopted. The means of verification for the fulfillment of the requirements and reporting are as per the DVM. Thus, compliance with JI relevant guidance is ensured, too.
The work starts with a contract review and the appointment of the TÜV SÜD assessment team covering the technical scope(s) and area(s) as well as relevant host country experience for evaluating of this JI project activity. The principles of consistency and transparency, impartiality, independency and safeguarding against conflicts of interest and confidentiality were considered by the TÜV SÜD Certification Body (CB) and the management of the department before accepting the verification contract.
Once the monitoring report is published on TÜV SÜD publication platform in internet "netinform" (as it is the matter of JI Track-1 project), the TÜV SÜD assessment team has carried out a desk review, on-site inspection, follow-up actions, resolution of issues identified and prepared a verification report.
The verification report and other supporting documents then undergo an internal quality control by the TÜV SÜD Certification Body before its submission to the DFP (host country) for the final approval.
In order to ensure transparency, assumptions are clearly and explicitly stated, audit evidences and further background material are clearly referenced in Annex 2 of this report. Project and methodology-specific checklists and a customised protocol have been developed for the project. The protocol shows criteria (requirements) in a transparent manner, the discussion of each criterion by the assessment team and results of the subsequent verification.
The verification protocol (Annex 1) serves the following purposes.

- It organizes, details and clarifies the requirements a JI project is expected to meet;
- It ensures a transparent verification process where the verifier will document how a particular requirement has been proved and the conclusion provided by the verifying team

The findings are the essential part of this verification report, which are summarized in Annex 1 of the verification protocol

2.2 VERIFICATION TEAM

The appointment of the verification team takes into account the technical area(s), sectoral scope(s) and relevant host country experience required amongst team members for verifying the ER achieved by the project activity in the relevant monitoring period for this verification.

The verification team consisted of the following members:

Name	Qualification	Coverage of scope 1	Coverage of technical area 1.2	Host country experience
Robert Mitterwallner	**ATL**	☑	☑	☑
Georgios Agrafiotis	Verifier	☑	☑	
Constantin Zaharia	Verifier			☑

The on-site verifier was Mr. Constantin Zaharia. During the on-site visit from 28-02-2012 to 01-03-2012 a telephone conference has been held with participation of the other 2 team members and the PP.

Robert Mitterwallner is located at TUV SÜD Industrie Service in Munich since 1990 and has a background as auditor for environmental management systems, as expert in environmental permit procedures for industrial plants and as expert for environmental impact studies assessment. He has received training in the JI determination/verification and CDM validation/verification process and applied successfully as GHG Determiner, GHG Validator, GHG Verifier as well as Assessment Team Leader and Technical Reviewer for climate change projects, among others, in the scope energy industries. He is experienced with hydro power determinations/validations and he has been appointed as Auditor for Renewable Energy Certification.

Georgios Agrafiotis has been appointed as verifier for the determination, validation and verification in JI and for voluntary projects within TÜV SÜD Industrie Service GmbH. He received intensive training at Carbon Management Service with TÜV SÜD and participated as GHG auditor in more than 40 validation and verification processes with various scopes.

Constantin Zaharia is environmental engineer and is working as freelancer for the Carbon Management Service Department of TÜD SÜD Industry Service GmbH, Germany.

2.3 REVIEW OF DOCUMENTS

The first MR was assessed based on all the relevant documents. The aims of the desk review were:

- verify the completeness of the data and the information presented in the MR,
- check the compliance of the MR with respect to the monitoring plan rev.2, dated March 2008. Particular attention to the frequency of measurements, the quality of the metering equipment including calibration requirements, and the quality assurance and quality control procedures was paid,
- evaluate the data management and the quality assurance and quality control system in the context of their influence on the generation and reporting of emission reductions.

A complete list of all documents reviewed is available in annex 2 of this report.

2.4 ON-SITE ASSESSMENT AND FOLLOW-UP INTERVIEWS

During 28/02/2012 to 29/02/2012, TÜV SÜD performed a physical site inspection including on-site interviews with the project participants as to:

- confirm the implementation and operation of the project,
- review the data flow for generating, aggregating and reporting of the monitoring parameters,
- confirm the correct implementation of procedures for operation and data collection,
- cross-check the information provided in the MR with other sources,
- check the monitoring equipment against the monitoring plan presented in the project design documents and the applied methodology, including calibrations, maintenance, etc.,
- review the calculations and assumptions used to obtain the GHG data and ER,
- check if the QC/QA procedures are in place for preventing and correcting of errors or/and omissions in the reported data.

A list of the persons interviewed during this verification activity is included in annex 2.

2.5 QUALITY OF EVIDENCE TO DETERMINE EMISSION REDUCTIONS

Among several evidences submitted, the following relevant and reliable evidence material has been used by the audit team during the verification process:

- License (IRL2)
- Monitoring report (IRL26)
- Raw data (IRL14)
- Data for cross-check (IRL14, IRL15)
- Quality assurance and quality control documents (Monitoring Plan) (IRL4, IRL10)
- Calibration documents (IRL17)

Sufficient evidences and data covering the full verification period in the required frequency is available to validate the figures stated in the final MR. The source of the evidences and data will be discussed in chapter 3 of this report. Specific cross-checks have been done in cases when further sources were available. The monitoring report figures were checked by the audit team against the raw data. It can be confirmed that the data collection system meets the requirements of the monitoring plan as per the applied methodology.

2.6 RESOLUTION OF CLARIFICATION, CORRECTIVE ACTION AND FORWARD ACTION REQUESTS

The objective of this phase of the verification process is to resolve any outstanding issues, which require clarification for TÜV SÜD's conclusion on the reported GHG emission reduction. The findings raised as Forward Action Requests (FARs) (if any) indicated in previous reports (determination/verification) were discussed and resolved during this phase through communication between the PP and TÜV SÜD.
To guarantee the transparency of the verification process, the concerns raised in the desk review, the on-site audit assessments and the follow up interviews together with the responses that have been provided by the PP are documented in Annex 1 (verification protocol).

A **Corrective Action Request** is raised where TÜV SÜD identifies:

- non-conformities in monitoring and/or reporting with the monitoring plan and/or methodology;
- that the evidence provided is not sufficient to prove conformity;
- mistakes in assumptions, data or calculations that impair the ER calculations;
- FARs raised during determination or previous verifications that are not solved until the on-site visit.

A **Clarification Request** is raised where TÜV SÜD does not have enough information or the information is not transparent in order to confirm a statement or data.

A **Forward Action Request** is raised where TÜV SÜD identifies that monitoring and/or reporting require special attention or adjustments for the next verification period.
Information or clarifications provided as a response to a CAR, CR or FAR could also lead to a new request.

2.7 INTERNAL QUALITY CONTROL

As a final step of the verification process, the verification documents including the verification report and the annexes have to undergo an internal quality control by the Certification Body (CB) "climate and energy". Technical Reviewers appointed by the CB carry out the review work. Each report has to be finally approved either by the Head of the CB or the Deputy. In case one of these two persons is part of the assessment team, the approval can only be given by the person who is not a part of the assessment team work. If the documents have been satisfactorily approved, the Request for Issuance is submitted to the involved parties along with the relevant documents.

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3 VERIFICATION RESULTS

In the following sections, the results of the verification are stated. The verification results relate to the project performance as documented and described in the determinated project design documents, the Determination Report, and the final Monitoring Reports (version 2, dated 19/07/2012). The verification findings for each verification subject are presented below.

3.1 FARS FROM THE PRE-JI VERIFICATION

Five FARs have been raised in the TÜV SÜD pre-JI Verification Report No. 600500232, dated 06-06-2011:

Forward Action Request 1: ***QM/QA application on Project activity***: Please provide operational procedures regarding implementation of the approved QM/QA systems related to the emission reduction project activity (data cross check, meter calibration cross check, data transfer cross check).
FAR 1, means of verification
The Annex 5 of the Monitoring Plan (IRL 8) together with updated procedures PO-HE-PF-138 and PO-HE-PF-190 (IRL 21, 22) including QM/QA activity and the procedures related to the JI Project have been submitted. The QM/QA system is documented and operational as checked during the site verification.
FAR 1, changes in the MR or related documents
n/a
Forward Action Request 2 ***Emission Reductions Calculation***: For a systematic cross check of the measured raw data and the data used for the emission reduction calculations, following information has to be provided for the next periodic verification. - An excel workbook (with parameter description for each column) with the same model equations should be provided for a systematic cross check of the daily and monthly results (instead of using the implicit FORTRAN calculation). - Indication of any deviation between the monthly measured electricity data at the internal electricity meters and the external meters (owned and operated by the state entity OMEPA) installed at the 220 kV high-voltage lines.
FAR 2, means of verification
During the verification excel workbooks (IRL 29) were provided to the audit team: Spot checking between the monthly measured electricity data at the internal electricity meters and the external meters (IRL 14, 15) was performed during the audit showing adequate results.
FAR 2, changes in the MR or related documents
n/a

Forward Action Request 3 ***Monitoring Report Format*** The Monitoring Report has to follow the CDM MR template of UNFCCC.
FAR 3, means of verification
The Monitoring Report (IRL 26) has been checked and it is confirmed that the CDM MR template of UNFCCC was used.
FAR 3, changes in the MR or related documents
n/a
Forward Action Request 4 ***Project Description*** A transparent project description has to be integrated in the Monitoring Report as follows: - Scope of the Project (increase of turbine capacity and turbine efficiency of three turbine units HG1, HG2, HG3 by refurbishment works) - The cascade system covering both PdF I and PdF II and impact on plant operation (interdependence) - Information on the implementation of refurbishment works at each turbine unit and the commissioning dates (timeline) - Information on power generation forecast due to project implementation and the measured power of the refurbished turbine units and discussion of any deviations -. Information on the impact of the operational status (turbine history: repair/maintenance etc.) of the turbines related to power generation.
FAR 4, means of verification
As part of the change in MR template, (see FAR 3 above), a project description has been integrated in the Monitoring Reports, Chapter B.1 (IRL 26).
FAR 4, changes in the MR or related documents
n/a
Forward Action Request 5 ***Monitoring and Data management*** The monitoring report has to refer to monthly data reading & recording and transfer procedure(s) at the external meters by OMEPA. Any periodic meter calibration has to be mentioned in the MR. - Monthly data sheet containing the electricity measured at the external electricity meter and supplied to the grid signed by Hidroelectrica and the grid operator (Transelectrica) staff have to be provided as annex to the MR. - Monthly data sheet containing the data on supplied electricity to the grid read & recorded at the internal electricity meters covering the verification period have to be provided as annex to MR. - An Excel workbook with a cross-check of data recorded at the external meter (installed at the 220 kV TM line at the TM station) and at the internal meter onsite (SCADA) covering the verification period have to be provided.
FAR 5, means of verification
The following documents were provided: - MR with monthly data reading & recording and transfer procedure(s) at the external

meters by OMEPA. The calibrations (main/back-up) are included too (IRL 17) - Invoices with the grid operator Transelectrica (IRL 14) - Data recorded at the external meter (installed at the 220 kV TM line at the TM station) and at the internal meter onsite (SCADA) covering the verification period were provided for cross-check (IRL 15)
FAR 5, changes in the MR or related documents
The Table included in chapter C. of the MR (IRL 6) includes the calibration requirements and the scheme describes the data acquisition and transfer procedure.

3.2 PROJECT IMPLEMENTATION IN ACCORDANCE WITH THE RE-DETERMINATED PROJECT DESIGN DOCUMENTS

The project is implemented according to the final Monitoring Plan, incl. annexes.
The verifier confirms, through the visual inspection of the turbines and corresponding design schemes that all physical features of the proposed JI project activity including data collecting and storage systems have been implemented in accordance with the final Monitoring Plan, incl. annexes. The project as described above is completely operational since 25-03-2007, as was confirmed during on-site visit.

In the monitoring period 2008 to 2011 the result of the emission reductions with 584,724 t CO_2e differs from the estimated value of 680,190 t CO_2e in the final Monitoring Plan ver. 2 dated March 2008. The estimated values are calculated with the energy produced in the average hydraulic year. The difference occurs due to the hydrology on the Danube in this specific year.
The following table summarizes the difference between PDD estimations and Project emissions:

Year	**2008**	**2009**	**2010**	**2011**	**Total ERU**
CEF (tCO_2/GWh)*	840	820	800	779	-
ERU (tCO2) estimated	176,400	172,200	168,000	163,590	680,190
ERU (tCO_2) realised	169,711	154,135	168,791	92,087	584,724

3.3 COMPLIANCE OF THE MONITORING SYSTEM WITH THE MONITORING PLAN

The monitoring system has been implemented in accordance with the re-determined monitoring plan incl. annexes (IRL 4).
All parameters during the monitoring period were monitored and evaluated as per the Monitoring Plan. Hereby following parameters have been verified (meter specific details see chapter 2.2. of the protocol):

Data / Parameter:	P
Data unit:	MWh
Description:	Electricity generated by the hydro units: 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. The net electricity is calculated by subtracting the internal consumption calculated as 0.4% of the total energy produced.
Source of data used:	The electricity measured at the each turbine (generator), HG_i is the data source used for the ERU calculations. The meters installed at the 220 kV

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high-voltage line, TH_i (property of OMEPA), the independent state entity in charge of the metering devices and invoicing issues, are used as back-up. Following data sources were used :

Meter	Paremeter	Type	Serial number	Metrological verification report	
				number	Validity (years) Calibration date
HG1	Energy produced (main)	A1R-L+	02679304 02712503	01522984/2004 01530942/2008	5 14/09/2004 8 2008*
HG2	Energy produced (main)	A1R-L+	05038484	01521713/2003	10 2003
HG3	Energy produced (main)	A1R-L+	05002175	01519945/2002	10 2003
TH1	Energy in 220kV station turbine 1 (backup)	ZMU202C.4r41f9	77425125	TM2023039 01.07.2003	10 2003
TH2	Energy in 220kV station turbine 2 (backup)	ZMU202C.4r41f9	77425126	TM2023039 01.07.2003	10 2003
TH3	Energy in 220kV station turbine 3 (backup)	ZMU202C.4r41f9	77425127	TM2023039 01.07.2003	10 2003

* the meter has been installed on 06/05/2009

The metering equipment used has been calibrated according to the requirements of the approved monitoring plan. The accuracy of the used meters is 0.2%.

Means of verification/Comments:

According to the project specific methodology, the net electricity supplied to the grid is measured hourly and recorded monthly. The hourly measured electricity is used in applied model equations as to determine the additional electricity achieved by the refurbishment works. This additional electricity amount consists of two components :

- Ea: Additional electricity achieved by the refurbishment of the turbine blades. Ea is determined with the hourly measured electricity data.
- Eb: Additional electricity achieved by the improved efficiency of the turbine-generator units. Eb is determined by using the hourly measured electricity together with the calculated head in the efficiency head-power chart developed by the company ASTRÖ.

Cross-check

The electricity output of the turbine-generator units is measured at the meters installed at the turbine. The measured electricity at the 220 kV Transelectrica 220 kV TM station is measured by OMEPA.

The electricity data recorded by the meters at the 220 kV HV station Transelectrica have been cross checked against the measurements of the meters at the turbines (IRL 14). The deviation is found to be less than 0.4 % and therefore within the approved uncertainty level.

Data / Parameter:	Head
Data unit:	m
Description:	The upstream and downstream water levels are measured by level meters ("Telelimnimetru") positioned on the Danube river. The head is calculated as the difference between the measured upstream water level data and downstream water level data .The measuring devices are constructed as to avoid any disturbances caused by waves ("hydraulic noise") or floating effects. The accuracy of the level meter devices is 0.15% (checked during the re-determination of the project – IRL 7).
Source of data used:	Electronic raw data gained from automatic readings of the level-meters are

	transferred electronically to the SCADA system. The calculated head data is used for the determination of efficiency factors in the head-power charts established by ASTRÖ.
Means of verification/Comments:	According to the applied calculation model, the water levels are monitored continuously; they are read and recorded hourly. The difference between upstream and downstream level data results in the Head.
Cross-check	The maintenance and calibration of the level-meters is controlled by the Romanian and Serbian authorities in charge of the hydro power plant operations at Portile de Fier I. The cross-check by Romanian and Serbian authorities is continuous; the by-annual calibration of the devices is performed by geodesic measurements led by the common technical staff of both sides (IRL 18). Together with the total electricity production data, the head is included also in to the regular bi-annual reports and cross checked in meetings. The deviations on both sides were found to be less than 0.1%.

Data / Parameter:	Increased efficiency $\Delta \eta_t$
Data unit:	%
Description:	Turbine efficiency factors are determined by using the measured hourly generated electricity and the calculated head in the model data head-power chart developed by ASTRÖ (Anstalt für Strömungsmaschinen, Austria). The efficiency factors in the non-refurbished status are determined in a separate head-power chart. The difference is used in the model to calculate the energy increase due to turbine efficiency improvements, as outlined in the Monitoring Plan.
Source of data used:	The entity ASTRÖ has developed a simulation model for the refurbished turbines. The model data for the reference (non-refurbished) turbines was simulated as well. The turbine efficiency η_t was determined by using the recorded hourly energy and the head and apply them in to the model data for refurbished and non-refurbished turbines. The difference $\Delta\eta = (\eta_{tr} - \eta_{tn})$ is indicated as the increase in efficiency.
Means of verification/Comments:	According to the model equations described in the Monitoring Plan, the efficiency factors are read on the head-power charts established by ASTRÖ. The hourly determined head / power data pair is used to read the efficiency factors under refurbished and non-refurbished conditions. In ranges where the head-power data chart does not have matching model data, the next available lower power data at the same head is chosen and the efficiency readings are repeated with the new data pair (same head/lower power).
Cross-check	The project participant has handed over the complete head-power chart regarding the refurbished/non-furbished conditions. In ranges where the head-power data chart does not have a matching model data, the next available lower power data at the same head is chosen and the efficiency readings are repeated with the new data pair (same head/low power). The data was cross checked on exemplary head/power data pairs and found to be correct and conservative.

The monitoring activities are strictly organised and written down in the re-determined Monitoring Plan. The responsibilities are determined and quality assurance measures are implemented on-site. The clear distribution of the monitoring duties has been demonstrated by the staff during the on-site visit (IRL 8).

The staff gets regular training on monitoring procedures (IRL 37 of the Initial Verification). The company Hidroelectrica has a certified quality and environmental management system (ISO

9001, ISO 14001), where the training and qualification procedures have been described and implemented.

3.4 ASSESSMENT OF DATA AND CALCULATION OF GREENHOUSE GAS EMISSION REDUCTIONS

All data have been available and all the parameters have been monitored in accordance with the monitoring plan.

The reported data of P, H, η_t, have been cross-checked against other sources available as explained above in chapter 3.3. As a result, the verifier confirms that the data of P, H, η_t are consistent and viable.

The input data of the calculations have been checked against the raw data. The verifier confirms that there are no deviations between raw data and input data. The audit team has been provided with data covering the whole monitoring period (01-01-2008 until 31-12-2011).

The calculations are based on a FORTRAN programme. The verification team performed spot checks for the whole monitoring period 2008 – 2011 (see the Annex 1 - Verification Protocol). Moreover, any value of the excel documents can be traced back using the information for "Head", "Power" and ASTRÖ model – "ASTRÖ Test Report No. T241". There were no inconsistencies found. The algorithms and formulas of the Fortran program have been checked during on-site visit by spot checks (four spot checks for each of the monitoring year 2008 – 2011, see Annex 1). Based on the random spot checks done on-site and his expertise, the verifier confirms that the algorithms and formulas implemented in the Fortran program were verified and accepted. Furthermore, the verifier confirms that the algorithms and formulas given in the monitoring reports are consistent with those in the Fortran program.

In the case of $\Delta\eta_t$, the turbine efficiency increase has been chosen in a conservative manner as described in chapter 3.3.

The external grid emission factor was fixed ex-ante.

The electronic transfer of raw data to usable data was cross checked. No mistakes have been detected.

The observations of the audit team left no doubt that the monitoring process has been implemented in accordance with the procedures described in the Monitoring Plan presented in the determinated project design documents.

As already pointed out in chapter 3.2 of this report, the monitored emission reductions were lower than the estimated value in the final Monitoring Plan ver. 2 dated March 2008. The reason is that the estimated values are calculated with the energy produced in the average hydraulic year and apart from 2010 all years during this monitoring period resulted in a rather low water flow compared to the average value as of the MP. This justification is deemed to be reasonable for the AIE.

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4 SUMMARY OF FINDINGS

The verifier can confirm that the published MR and related documents are complete and verifiable in accordance with the JI track 1 requirements. All the findings raised by the verification team, the responses by the PPs and the conclusion of the audit team are presented in Annex 1.
The means of verification and resulting changes in the MR or related documents are summarized in the table below:

Corrective Action Request 1: On the first page of the MRs a date and a version number shall be included.
CAR 1, means of verification
The new Monitoring Report include on the first page: Version 3, September 26, 2012, as checked with the documents (IRL 26)
CAR 1, changes in the MR or related documents
First page of the MR version 3 includes the version number and the date.
Corrective Action Request 2: All grammar mistakes, formal mistakes, typos, inconsistencies and non-conservative assumptions have to be revised in the MR
CAR 2, means of verification
The verification team checked the revised MR ver. 3 and concluded that the following corrections made by the PP answer completely to the request of the CAR 2: - Wording at page 7 - The "netto value" corrected in MRs 2009-2011 - Table at page 7 (MRs for 2010 and 2011) – the sum-up is corrected - Table at page 5 – meter identification is correct (TH) - The yearly ERUs values are rounded - The SI units and abbreviations are correctly used - A legend has been included at page 3 for identification of the scheme - The year 2012 has been excluded from calculations - In table with meter calibration is indicated the date of the last calibration performed - The correct estimations for ERs, as included in the MP rev. 2 are used in the calculations - The discussion presented in Chapter E.6 regarding the revision of the monitoring methodology has been deleted - Chapter E.5 has been reviewed - In Chapter E.1 the formula for baseline calculation is now included The monitoring parameters are now consistent with MP
CAR 2, changes in the MR or related documents
MR version 3 has been corrected for the above mentioned issues.
Corrective Action Request 3 The grid EF for 2010 is different compared with the same EF as included in the MP (799 and 800). Correction is requested. The ERUs calculation shall be revised and consistency throughout the documents including xls files shall be ensured.
CAR 3, means of verification
The grid EF for 2010 is corrected in the new MRs ver. 2 (IRL 26). The excel calculation files have been updated also («2008pf1 ver 02.1.xls», («2009pf1 ver 02.1.xls», («2010pf1 ver 02.1.xls», («2011pf1 ver 02.1.xls», IRL29).
CAR 3, changes in the MR or related documents
MR version 2, Excel calculation files ver. 02.1

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Corrective Action Request 4 **In the documents "E_200x":** - Title is missing - The parameters Ebr and Enet are not defined - URE is used for emission reduction (English) - The data presented in Excel files are not transparent. Correction is requested
CAR 4, means of verification
The "E-200x" files include a title and were corrected (IRL28). The parameters Ebr and Enet are defined in the new version of the Monitoring Report (IRL26), however see CAR 7 below.
CAR 4, changes in the MR or related documents
MR version 2
Corrective Action Request 5 There is no header with data/units in the Excel files Correction is requested.
CAR 5, means of verification
The new excel files include a header with data/units (IRL27), however see CAR 7 below.
CAR 5, changes in the MR or related documents
Excel calculation files ver. 02
Corrective Action Request 6 Chapter E.6 shall be revised considering only the difference between ex-ante values estimated in the MP ver.1 dated October 2007 and Project values.
CAR 6, means of verification
The Monitoring Reports, Version 2, July 19, 2012, is corrected (IRL26).
CAR 6, changes in the MR or related documents
MR version 2
Corrective Action Request 7 1. The Excel calculation files have the same name as the initial ones. A version number shall be included in the name of the files 2. The hour "1" from 01/01/yyyy is missing 3. Definition of the parameters ηref and ηext is missing 4. η1 is used also for HG 2 and HG 3
CAR 7, means of verification
The new excel files (IRL 29), were corrected. The "E-200x" files were renamed and the new file name includes "ver 02". The hour "1" from 01/01/yyyy were included and the parameter η were corrected accordingly the HG
CAR 7, changes in the MR or related documents
Excel files version 02.1.
Clarification Request 1: An explanation regarding the low energy production during the year 2011 is requested.
CR 1, means of verification
During 2011 the flow on Danube was low, respectively 4209 m^3/s comparing with the median stream flow for Danube of 5520 m^3/s; 2011 was a very dry year. This information has been compared with level meter records and found consistent.
CR 1, changes in the MR or related documents
N/A

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5 VERIFICATION STATEMENT

TÜV SÜD Industrie Service GmbH has performed the first periodic verification of the JI track 1 project: **"**Modernization of 3 hydro units in Portile de Fire I hydro station**"**.
The verification is based on the currently valid documentation of the UN Framework Convention on Climate Change (UNFCCC) and takes into account in general all requirements for JI projects as well as specific national regulations as described in the Romanian National JI Track I Procedure of the Romanian DFP.
The management of SC Hidroelectrica S.A. is responsible for the preparation of the GHG emissions data and the reported GHG emission reductions on the basis set out within the project re-determined Monitoring Plan.

The verifier can confirm that:

- the development and maintenance of records and reporting procedures are in accordance with the monitoring plan;
- the project is operated as planned and described in the MP;
- the installed equipment being essential for generating emission reduction runs reliably and is calibrated appropriately;
- the monitoring system is in place and generates GHG emission reductions data;
- the GHG emission reductions are calculated without material misstatements;
- the monitoring plan in Monitoring Report is as per the re-determined MP
- that the re-determined monitoring plan is in accordance with the approach taken regarding baseline setting and monitoring (please see Appendix B of the JI Guidelines – Decision 9 COP/MOP).

Our opinion is based on the project GHG emissions and resulting GHG emission reductions reported, which have been determined through the approved project baseline, monitoring plan and associated documents.

Based on the information we have checked and evaluated, we confirm the following statement:

Reporting period: from January 1, 2008 to December 31, 2011

Emission reductions in 2008:	169,711
Emission reductions in 2009:	154,135
Emission reductions in 2010:	168,791
Emission reductions in 2011:	92,087

Total Emission Reductions (ERU): **584,724** t CO_2e

Munich, 14-11-2012

Thomas Kleiser
Certification Body "climate and energy"

Munich, 14-11-2012

Robert Mitterwallner
Assessment Team Leader

Industrie Service

Annex 1: Verification Protocol

Verification Protocol

Project Title: Modernisation of 3 hydro units in Portile de Fier I hydro station, Romania

Date of Completion: 14 November 2012

Number of Pages: 58

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Table of Contents

Project Activity Implementation

1.1. Technology

PDD	Verified Situation	Conclusion
Location (s)		
Description / Address: The project Portile de Fier I is located at the Danube near the city Dobreta Turnu Severin. The large hydropower plant consists of 6 turbine + generator units. All of the 6 units are refurbished, but only turbine No. 1, 2 and 3 are considered within the project boundary: "CO2 reduction by modernisation of 3 hydro units within Portile de Fier I". The purpose of the project is to increase the installed power and the efficiency of the existing units' No. 1, No. 2 and No. 3 and reduce the fossil fuel power generation.	The project site has been visited on 28 and 29 February 2012. The turbine + generator units and corresponding measuring and maintenance equipment were checked and documented. The operational control center within the plant has been visited.	☑ IRL29
GPS coordinates:	N: 44° 21' , E: 22° 31'	☑
Technical Equipment – Main Components		
Turbine unit HG 3 Vertical Kaplan turbine with concrete spiral casing , symbol of turbine :	The refurbished unit No.3 was in operation as seen during site visit of the plant.	☑ IRL24

PDD	Verified Situation	Conclusion
KVB 194-25.5		
Technical Features *Turbine unit HG 3* The original installed capacity of the turbine unit 3 (175 MW) was increased to 194.5 MW after refurbishment. Furthermore the efficiency of the turbine was increased from 94.24% to 94.74% approximately. The project enhances the installed power by 19.5 MW per unit. *Generator HG 1 :* The generator was refurbished by ABB. Documents describing the refurbishment works were submitted to the audit team. The generator is upgraded from 190 MVA to 216 MVA.	The turbine unit No.3 was set in operation by 24.08.2003. The refurbishment works for the turbine + generator unit included many components : - turbine - generator - auxiliary installation and - automation The power increase was achieved by a flow rate increase from 725 m^3/s to 840 m^3/s per turbine unit. Further power increase was achieved by modifications at the turbine equipment (efficiency increase). The refurbishment works were completed by VA TECH (turbine). Relevant documents describing the refurbishment works were submitted to the audit team. Furthermore evidence on the maintenance contract with the service company Hidroserv (RO 3/27.01.2010) was presented to the audit team. The cooling of the units is provided by processed water: There are separate cooling systems for stator and rotor. The turbine oil is cooled by a separate system (water + heat exchangers).	☑
Component 2 : *Description* *Turbine HG 2*	Similar with unit HG 3	☑
Component 2 : *Technical Features* *Turbine HG 2* *Generator HG 2*	The turbine unit No.2 was set in operation by 17.10.2004.	☑

PDD	Verified Situation	Conclusion
Component 1 : *Description* *Turbine HG 1*	Similar with unit HG 3	☑
Component 1 : *Technical Features* *Turbine HG 1 :* *Generator HG 1*	The turbine unit No.1 was set in operation by 25.03.2007. .	☑
Operation Status during verification		
Approvals / Licenses N/A	The operation of the refurbished units and the supply of the additional generated electricity into the grid was approved by ANRE licence issued on 24.07.2001 (332) and updated on 08.07.2005 (rev. 2). Validity period 25 years.	IRL 2 ☑
Actual Operation Status N/A	Under construction ☐ In operation ☒ Out of operation ☐ Reason (when out of operation):	☑
Remarks to Special Operational Status During the Verification Period	The operation regime of the power plant is linked to the national grid demands and to demand of the contractors. Evidence on the annual operation time (turbine log) for the turbines No. 1,2,3 for the whole crediting period 2008 – 2011 has been provided to the verification team IRL 14, 15, 18). Overflow has been documented for each of the monitoring period 2008 – 2011 (IRL 16	☑

PDD	Verified Situation	Conclusion
	– Sesiunea 74 - 84). (Serbian-Romanian_Sessions)	

1.2. Organization

PDD	Verified Situation	Conclusion
Project Participant (s)		
Entity / Responsible person: S.C. Hidroelectrica S.A. is the plant operator and project owner Senter Novem is the purchaser of the generated ERUs.	The hydro power plant is operated and managed by S.C. Hidroelectrica S.A., a state owned company. The generated electricity is supplied into the Romanian power grid.	☑
CDM / VER Project management: As per the contract No. ERU 01/01 and internal management decision No. 370, Mr. Dragos Zachia signs for general executive and Mr. Dragos Novac is in charge of the technical implementation and management of the project.	Mr Dragos Novac is the executive in charge of the project implementation. Mr. Cristian Bocse is responsible for the implementation of the methodologies and for the calculation of ERUs , Mr. Ciprian Rachitan is responsible for the electrical part including metering system. Mrs. Dana Horhoianu is coordinator of the project at Hidroelectrica Headquarters in Bucharest.	☑

1.3. Quality Management System

PDD	Verified Situation	Conclusion
Quality Management Manual: Hidroelectrica S.A. implements a QM system ISO 9001 at its headquarters in Bucharest.	Qualiy control and quality assurance procedures concerning the "CO2 reduction project" at the power plant PdF I are not integrated in the existing Quality Management Systems (ISO 9001, ISO 14001, OHSAS 18001) implemented in Hidroelectrica S.A. However, the procedures on data processing, calibration and maintenance of metering devices, operation of turbine equipment and internal reviews are included in the current working procedures "Reglementari SCDE" common for Romanian/Serbian parties (IRL 21, 10)	☑
Responsibilities: Mr. Dragos Zachia is in charge of the project management coordination and implementation.	An organigram with general responsibilites in the project management has been provided to the audit team. Mr. Christian Bocse in charge of data processing and calculation procedures. Staff in charge of other important topics like calibration and maintenance of metering devices, management of SCADA data acquisition and processing system has not been named in the organigram. See Annex 5 to MP (IRL 9).	☑
Qualification and Training: Mr. Christian Bocse is responsible for the technical process design.	Technical details on the project were explained by Mr. Christian Bocse. He is also in charge of the methodology for the calculation of additional energy amounts. Information on the metering devices (calibration, functionality), process diagramme (single line diagram) and data processing were provided by Mr. Ciprian Rachitan. Mr. Danut Caplea is responsible for the SCADA system and data safety measures.	☑ (IRL 9)
Implementation of QM-system	Evidence on the implementation of quality management efforts linked with the data acquisition and safety (e.g. ISO 9001, ISO 14001 and OHSAS) provided during the audit.	☑ (IRL 10)

1.4. Remaining FARs from previous Verifications (or forwarded issues of validation report)

Remaining Requests from Previous Verifications	Summary of project owner response	Audit team conclusion
Forward Action Request No.1 ***QM/QA application on Project activity***: Please provide operational procedures regarding implementation of the approved QM/QA systems related to the emission reduction project activity (data cross check, meter calibration cross check, data transfer cross check).	- The QM/QA activity and the procedure therein are described in Annex 5 of the Monitoring Plan	The Annex 5 to MP has been checked and it can be confirmed that all the steps, starting with raw data up to the Monitoring Report elaboration, are included (IRL 9). This issue is closed.
Forward Action Request No.2 ***Emission Reductions Calculation***: For a systematic cross check of the measured raw data and the data used for the emission reduction calculations, following information has to be provided for the next periodic verification. - An excel workbook (with parameter description for each column) with the same model equations should be provided for a systematic cross check of the daily and monthly results (instead of using the implicit FORTRAN calculation).	During the verification the following were provided to the audit team: - An excel workbook (with parameter description for each column) with the same model equations. - spot checking of the deviation between the monthly measured electricity data at the internal electricity meters and the external meters was performed during the audit showing adequate results	The documents have been provided and checked. This issue is closed.

Remaining Requests from Previous Verifications	Summary of project owner response	Audit team conclusion
- Indication of any deviation between the monthly measured electricity data at the internal electricity meters and the external meters (owned and operated by the state entity OMEPA) installed at the 220 kV high-voltage line.		
Forward Action Request No.3 ***Monitoring Report Format*** The Monitoring Report has to follow the CDM MR template of UNFCCC.	The CDM MR template of UNFCCC was used when issuing the Monitoring Report format.	The following documents have been provided: • "PdF I 2008 eng 20 feb 2012" (and for 2009, 2010 and 2011) • PdF I 2008 eng final (and for 2009, 2010 and 2011), dated 12/03/2012. This document is a result of the disscusions during the site verification. Both documents follow the CDM MR template of UNFCCC, however **Corrective Action Request No.1** On the first page of the MRs a date and a version number shall be included.
Forward Action Request No.4 **Project Description** A transparent project description has to be integrated in the Monitoring Re-	A project description has been integrated in the Moni-	The description has been included in the last version of MR ("PdF I 2008 eng final" – for ex.) (IRL 26) However, see CAR #1 above.

Remaining Requests from Previous Verifications	Summary of project owner response	Audit team conclusion
port as follows: - Scope of the Project (increase of turbine capacity and turbine efficiency of three turbine units HG1, HG2, HG3 by refurbishment works) - The cascade system covering both PdF I and PdF II and impact on plant operation (interdependence) - Information on the implementation of refurbishment works at each turbine unit and the commissioning dates (timeline) - Information on power generation forecast due to project implementation and the measured power of the refurbished turbine units and discussion of any deviations -. Information on the impact of the operational status (turbine history: repair/maintenance etc.) of the turbines related to power generation.	toring Reports. The cascade system covering both PdF I and PdF II and impact on plant operation (interdependence) was included in the Monitoring Report of PdF II where this interdependence is taken into account. Information on the implementation of refurbishment works at each turbine unit and the commissioning dates were included in the Monitoring Reports Information on power generation forecast due to project implementation and the measured power of the refurbished turbine units and discussion of any deviations were included in the Monitoring Plans. During the monitoring period 2008 – 2011 there were no special events or malfunctions, except the normal planned outage period for maintenance works, and therefore no impact could be reported.	
<u>Forward Action Request No.5</u> **Monitoring and Data management** The monitoring report has to refer to monthly data reading & recording and transfer procedure(s) at the external meters by OMEPA. Any periodic meter calibration has to be mentioned in	All required data and information were submitted.	The MR has been completed with the requested information, however See CAR #1 above

Remaining Requests from Previous Verifications	Summary of project owner response	Audit team conclusion
the MR. - Monthly data sheet containing the electricity measured at the external electricity meter and supplied to the grid signed by Hidroelectrica and the grid operator (Transelectrica) staff have to be provided as annex to the MR. - Monthly data sheet containing the data on supplied electricity to the grid read & recorded at the internal electricity meters covering the verification period have to be provided as annex to MR. - An Excel workbook with a cross checks of data recorded at the external meter (installed at the 220 kV TM line at the TM station) and at the internal meter onsite (SCADA) covering the verification period have to be provided.		

2. Data Management System

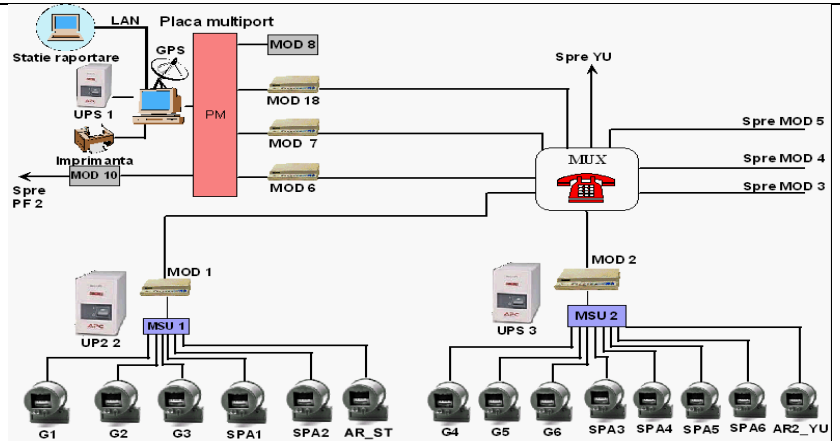
2.1. Description

Structure of raw data archiving				
Describe all the different data collection systems				
Type	Name	Responsible	Procedures	Comments
Manual	No manual data records	NA	NA	NA
PLC 1	Personal Computer (PC) with integrated server onsite PdF I	General Coordinator, IT manager, Calibration/Maintenance Manager	The metered raw data (generated electricity, levels) stored in a computer onsite. It is managed by a SCADA system.	☑
PLC 2	PC with integrated server at Hidroelectrica headquarters in Turnu Severin	General Coordinator, IT Manager, Calibration/Maintenance Manager	The metered raw data (generated electricity, level) is simultaneously transferred to a computer system at Hidroelectrica offices in Turnu Severin. It is managed by a SCADA system.	☑
Accounting N/A	*Invoice* N/A	NA	NA	☑
External data	The generated electricity supplied to the grid -	Transelectrica is responsible for calibration	NA The external meters are main-	☑

	recorded with meters sealed and controlled by Transelectrica, the grid operator.	and maintenance of meters. Therefore the metered data is regarded as "external".	tained by OMEPA, an affiliate of the grid operator Transelectrica. See IRL 21	
External data	Grid Emission Factor - issued by the Romanian authorities and accepted during the assessment of the baseline.	Technical Coordinator, Operation manager		Not part of the verification ☑
External data	Turbine Efficiency data vintage - report provided by the company ASTRÖ, Austria.	Technical Coordinator, Operation manager	The turbine efficiency data is determined according to a mathematical simulation, which was prepared by the company ASTRÖ, Austria. The model covers the efficiency of refurbished turbine and the unfurbished (original) turbine unit.	The comprehensive ASTRÖ model results are used for the purpose of energy increase calculations. This is done by implementing a program (FORTRAN), which allows a numerical solution for individual operational conditions depending on actual flow rate, head and power. The reports were handed over to the audit team.
Further Remarks: The raw data is recorded and processed automatically.				

2.2. Raw Data Archiving and Protection measures

Name	Description of data archiving and protection measures	Risks and comments	Concl.
Form a No manual data records	NA	NA	☑
Computer a Personal Computer (PC) with integrated server onsite PdF I	The metered raw data (generated electricity, levels) is stored in a computer onsite. It is part of a SCADA system used for raw data acquisition, transfer, processing and archiving. The data is archived in a data storage system managed by the IT department. The data is recorded in external backup CDs, which are kept in an air conditioned room in the Hidroelectrica building in Turnu Severin.	QM procedures: PO-HE-PF-129 ed.5, rev.0 "Administration of the software licensees and the informatics system of SH Portile de Fier; PO-HE-PF-190 ed.2, rev.0 "Electronic archiving of the documents. The verification team randomly checked the information from the computer a with the external data (invoice data) measured at the 220 kV HV station (IRL- 14)	☑
Computer b Personal Computer (PC) with integrated server at Hidroelectrica headquarters in Turnu Severin	The metered raw data (generated electricity, level) is simultaneously transferred to a computer system at Hidroelectrica offices in Turnu Severin. The data is read by optical sensors and transferred by : a. radio frequency transmission b. fibre optic cable network of Telecom Romania See below:	See above	☑

			
Invoice N/A		N/A	☑
Form e The generated electricity supplied to the grid - recorded with meters sealed and controlled by Transelectrica, the grid operator.	**Note** : The additional energy gained by various refurbishment measures is not identified or marked separately in the invoices. Therefore the invoices cannot be used for a comprehensive cross check of this energy fraction. However the daily/monthly generated total energy (power) data can be used for the crosscheck of the daily power data used in the calculations.	The delivered/consumed energy is calculated based on an algorithm established between the two parties at the power plant and unit level by SC Hidroelecrica SA – SH Porțile de Fier I and SC Transelectrica SA – S.T. Craiova. The invoicing and reimbursing to the grid (on the wholesale market) is made at Hidroelectrica SA level according to the Commercial Code provisions of the wholesale market in accordance with the commercial contracts/amendments concluded by Hidroelectrica. (IRL 13).	☑
Grid Emission Fac-	see remarks in 2.1	see remarks in 2.1	☑

tor issued by the Romanian authorities and accepted during the assessment of the baseline.			
Turbine Efficiency data vintage - report provided by the company ASTRÖ, Austria.	see remarks in 2.1	see remarks in 2.1	☑
Further Remarks: The raw data are stored in a redundant system (computer a and computer b) and is traceable also with the invoices between Hidroelectrica and Transelectrica. The same information is in addition checked by the Serbian part. *The risks of losing the archived data are insignificant.*			☑

2.3. Data transfer

Description of data transfer from raw data archiving to calculation tool			
Name	Description and responsibilities	Risks and comments	Concl.
Form a No manual data records	NA	NA	☑
Computer a Personal Computer (PC) with integrated server onsite PdF I	See remarks in 2.2	See remarks in 2.1 and 2.2	☑
Computer b Personal Computer (PC) with integrated server at Hidroelectrica headquarters in Turnu Severin	See remarks in 2.1 and 2.2	See remarks in 2.1 and 2.2	☑
Invoice N/A	See remarks in 2.1 and 2.2	See remarks in 2.1 and 2.2	☑
Form e The generated electricity supplied to the grid - recorded with meters sealed and controlled by	See remarks in 2.1 and 2.2	See remarks in 2.1 and 2.2	☑

Transelectrica, the grid operator.			
Grid Emission Factor issued by the Romanian authorities and accepted during the assessment of the baseline.	See remarks in 2.1 and 2.2	See remarks in 2.1 and 2.2	☑
Turbine Efficiency data vintage - report provided by the company ASTRÖ, Austria.	See remarks in 2.1 and 2.2	See remarks in 2.1 and 2.2	☑
Further Remarks: Data transfer is performed automatically			☑

2.4. Data Processing

Description of data processing from transferred data to final results in the calculation tool			
Step	Description	Risks and comments	Concl.
Consistency	The methodology is based on the calculation of various metered data and test model data.		☑
Calculation Tool description	The calculation procedure has been described in the Monitoring Plan and corresponding annexes. As mentioned before, a huge data vintage with many recorded parameter data has been used for the calculation of additional energy, i.e. hourly and daily values were determined by using a numeric program (FORTRAN) implemented and demonstrated by the Operation Manager, Mr. Cristian Bocse. Details on the calculation procedures (some assumptions /simplifications) have been described by Mr. Bocse.	The raw data used for calculations are transfered automatically into the calculation computer. The risk is only if the computer program (FORTRAN) is not working properly. Spot check calculations were done by the audit team as a cross check using the excel tables with parameters for energy calculation. No discrepancies were found.	☑
Transformation from transferred data to useable data	The raw data sources used for energy calculations have been presented to the audit team for a spot check. The submitted data makes it possible to recalculate and check the results. All raw data was handed over to the audit team	No data can be missed. If data is missing, the registers are available and the data is collected again from these registers. Data are compared with previous data and any discrepancy can be either remarked from data collection or from data computation	☑
Elimination of not	The issue of not plausible data has not been mentioned.	The risk of not plausible data is much	☑

plausible data		reduced because the information is recorded automatically and checked twice on both computers (PdF and Headquarter in Turnu Severin)	
Transformation from useable data to input data for further calculation	The procedure of data transfer from to raw-usable has been described.	Control steps for the handling of usable data have been described in plausible way.	☑
Ex-ante data	na		☑
Default parameter	The EF for the grid were taken ex-ante and accepted during the initial determination of the project	N/A	☑
Formulae check	There is only one formula: $E_A = E_a + E_b = \sum_{1}^{8760}((P - P_{175}) + \Delta\eta * P)$ [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 efficiency represented by the difference between the efficiency of the refurbished unit and the old hydro unit	They were checked at the time of PDD development and during the project Determination. There are no changes of these formulae in the mean time	☑
Rounding functions	The results with digits are rounded as a mean of conservative approach.	The rounding used in the initial PDD was accepted at that time.	☑

Calculation tool changes and protection measures	The workbook could be filled only by the person responsible for workbook filling and in this regard no unauthorized changes could occur.	Mr. Constantin Guran (Romanian – Serbian operation coordinator) is the person dedicated to assure the control barriers into the calculation tool as to assure the use of original data from the measuring period. All data for a specific period are confirmed and included in the Annex 1 of the bi-annual Report (this Annex 1 is signed by Mr. Guran.	☑
Further Remarks: Faulty similar calculations by both parties may result from calculation or faulty monthly readings. Faulty monthly readings are automatically corrected either by data interpretation or by subsequent data readings.			☑

3. Monitoring Plan Implementation

3.1. List of Parameter to be monitored

ID-PDD	ID-Meth.	ID-Internal	Description	Conclusion
Instrumentation				
P	-	-	Generated Energy by the of refurbished units	☑
Upstream level	-	-	Used for calculation of η refurbished.	☑
Down-stream level	-	-	Used for calculation of η refurbished.	☑
External Data				
P_r	-	-	From refurbished data base	☑
P_{175}	-	-	From baseline data base.	☑
η_{base}	-	-	Efficiency of the old units. From baseline data base.	☑
EF_{grid}	-	-	As accepted in the determination Report	☑
Others				
Not appli-cable				☑

3.2. Monitoring Instrumentation

3.2.1. Instrument (QWG 002679304, ELSTER)

PDD	Verified Situation	Conclusion
Instrumentation Information		
ID-PDD:	**Main meter at the turbine HG1**	☑
ID-Internal:	Electricity at the medium voltage (15.6 kV) line before transformation station (to 220 kV)	☑
Data to be Measured:	Total electricity generation at turbine 1	☑
Data Logging:	Online monitoring, hourly reading, monthly recording	☑
Archiving of Raw Data:	Connected via modem to the server onsite and further transferred to HQ Hidroelectrica	☑
Measurement Principle:	3 phase quadrant, pulse measurement	☑
Period of Operating Time:	**from 25.03.2007** to 06.05.2009 when was replaced with GWG 002712503	☑
Instrument Type:	Current at the TM line, 0.2s active, 0.5S reactive	
Serial Number:	**QWG 002 679 304**	☑
Manufacturer Model Nr.:	ELSTER/ABB	☑
Specific Location:	The meter is located at the turbine G1, 15.6 kV line	☑
Measurement Range:	Voltage : (L) 57/100 V ac	☑

	Current : (M) 63.5/110 V ac I n 5 A 1 A I max 10 A 2 A	
Measurement Unit:	MWh	☑
Calibration:	14.09.2004	☑
Required Calibration Frequency:	5 years	☑
Uncertainty Level:	0.2 %	☑
Monitoring & Calculation		
Reading Frequency:	hourly	☑
Recording Frequency:	monthly	☑
Trouble Shooting:	n/a	☑

Inspection Results During Verification			
Operation of Instrumentation	Method of Verification	Verification Results	Conclusion
Measuring Principle:	3 phase quadrant digital meter, pulse	The installed electricity meter operated as 3 phase, quadrant digital meter.	☑
Installation:	Installed by the supplier ELSTER	3 phase, quadrant digital meter was installed onsite.	☑
Functionality:	It is referred to the specifications of the supplier.	The meter was installed at the turbine unit at 15.6 kV medium high voltage line and was operational.	☑
Quality assurance:	It is referred to the specifications of the supplier.	The calibration certificates were provided (IRL 29).	☑
Maintenance:	It is referred to the specifications of the supplier and the requirements of the grid operator.	N/A	☑
Further Remarks: N/A The meter has been replaced on 06.05.2009 with GWG 002712503			☑

3.2.2. Instrument (QWG 002712503, ELSTER)

PDD	Verified Situation	Conclusion
Instrumentation Information		
ID-PDD:	**Main meter at the turbine HG1**	☑
ID-Internal:	Electricity at the medium voltage (15.6 kV) line before transformation station (to 220 kV)	☑

Data to be Measured:	Total electricity generation at turbine 1	☑
Data Logging:	Online monitoring, hourly reading, monthly recording	☑
Archiving of Raw Data:	Connected via modem to the server onsite and further transferred to HQ Hidroelectrica	☑
Measurement Principle:	3 phase quadrant, pulse measurement	☑
Period of Operating Time:	**from 06.05.2009** to present	☑
Instrument Type:	Current at the TM line, 0.2s active, 0.5S reactive	
Serial Number:	**QWG** 002712503	☑
Manufacturer Model Nr.:	ELSTER/ABB	☑
Specific Location:	The meter is located at the turbine G1, 15.6 kV line	☑
Measurement Range:	Voltage : (L) 57/100 V ac (M) 63.5/110 V ac Current : I n 5 A 1 A I max 10 A 2 A	☑
Measurement Unit:	MWh	☑
Calibration:	24.03.2008	☑
Required Calibration Frequency:	8 years	☑
Uncertainty Level:	0.2 %	☑
Monitoring & Calculation		
Reading Frequency:	hourly	☑
Recording Frequency:	monthly	☑
Trouble Shooting:	n/a	☑

Inspection Results During Verification			
Operation of Instrumentation	Method of Verification	Verification Results	Conclusion
Measuring Principle:	3 phase quadrant digital meter, pulse	The installed electricity meter operates as 3 phase, quadrant digital meter.	☑
Installation:	Installed by the supplier ELSTER	3 phase, quadrant digital meter is installed onsite.	☑
Functionality:	It is referred to the specifications of the supplier.	The meter is installed at the turbine unit at 15.6 kV medium high voltage line and was operational.	☑
Quality assurance:	It is referred to the specifications of the supplier.	The calibration certificates were provided (IRL 21).	☑
Maintenance:	It is referred to the specifications of the supplier and the requirements of the grid operator.	N/A	☑
Further Remarks: N/A			☑

3.2.3. Instrument (YWG005038484, ELSTER/ABB)

PDD	Verified Situation	Conclusion
Instrumentation Information		
ID-PDD:	**Main meter at the turbine HG2**	☑
ID-Internal:	Electricity at the medium voltage (15.6 kV) line before transformation station (to 220 kV)	☑
Data to be Measured:	Total electricity generation at turbine 2	☑
Data Logging:	Online monitoring, hourly reading, monthly recording	☑
Archiving of Raw Data:	Connected via modem to the server onsite and further transferred to HQ Hidroelectrica	☑
Measurement Principle:	3 phase quadrant, pulse measurement	☑
Period of Operating Time:	From 17.10.2004 onwards in operation	☑
Instrument Type:	ELSTER	
Serial Number:	**YWG 005 038 484**	☑
Manufacturer Model Nr.:	ELSTER/ABB	☑
Specific Location:	The meter is located at the turbine G2, 15.6 kV line	☑
Measurement Range:	Voltage : (L) 57/100 V ac (M) 63.5/110 V ac Current : I n 5 A 1 A I max 10 A 2 A	☑
Measurement Unit:	MWh	☑

Calibration:	23.09.2003	☑
Required Calibration Frequency:	10 years	☑
Uncertainty Level:	0.2 %	☑
Monitoring & Calculation		
Reading Frequency:	hourly	☑
Recording Frequency:	monthly	☑
Trouble Shooting:	n/a	☑

Inspection Results During Verification			
Operation of Instrumentation	Method of Verification	Verification Results	Conclusion
Measuring Principle:	3 phase quadrant digital meter, pulse	The installed electricity meter operates as 3 phase, quadrant digital meter.	☑
Installation: Manner of execution	Installed by the supplier ABB	3 phase, quadrant digital meter was installed onsite.	☑
Functionality:	It is referred to the specifications of the supplier.	The meter is installed at the turbine unit at 15.6 kV medium high voltage line and was operational.	☑
Quality assurance:	It is referred to the specifications of the supplier.	The calibration certificates were provided.	☑
Maintenance:	It is referred to the specifications of the supplier and the requirements of the grid operator.	No maintenance records were presented so far.	☑
Further Remarks: N/A			☑

3.2.4. Instrument (YWG005002175, ELSTER/ABB)

PDD	Verified Situation	Conclusion
Instrumentation Information		
ID-PDD:	**Main meter at the turbine HG3**	☑
ID-Internal:	Electricity at the medium voltage (15.6 kV) line before transformation station (to 220 kV)	☑
Data to be Measured:	Total electricity generation at turbine 3	☑
Data Logging:	Online monitoring, hourly reading, monthly recording	☑
Archiving of Raw Data:	Connected via modem to the server onsite and further transferred to HQ Hidroelectrica	☑
Measurement Principle:	3 phase quadrant, pulse measurement	☑
Period of Operating Time:	From 04.08.2003 onwards in operation	☑
Instrument Type:	ELSTER/ABB	☑
Serial Number:	**YWG 005 002 175**	☑
Manufacturer Model Nr.:	ABB	☑
Specific Location:	The meter is located at the turbine G3 15.6 kV line	☑
Measurement Range:	Voltage : (L) 57/100 V ac (M) 63.5/110 V ac Current : I n 5 A 1 A I max 10 A 2 A	☑

Measurement Unit:	MWh	☑
Calibration:	14.08.2002	☑
Required Calibration Frequency:	10 years	☑
Uncertainty Level:	0.2 %	☑
Monitoring & Calculation		
Reading Frequency:	hourly	☑
Recording Frequency:	monthly	☑
Trouble Shooting:	n/a	☑

Inspection Results During Verification			
Operation of Instrumentation	Method of Verification	Verification Results	Conclusion
Measuring Principle:	3 phase quadrant digital meter, pulse	The installed electricity meter operates as 3 phase, quadrant digital meter.	☑
Installation:	Installed by the supplier ELSTER	3 phase, quadrant digital meter was installed onsite.	☑
Functionality:	It is referred to the specifications of the supplier.	The meter is installed at the turbine unit at 15.6 kV medium high voltage line and was operational.	☑
Quality assurance:	It is referred to the specifications of the supplier.	The calibration certificates were provided.	☑
Maintenance:	It is referred to the specifications of the supplier and the requirements of the grid opera-	No maintenance records were presented so far.	☑

	tor.		
Further Remarks: N/A			☑

3.2.5. Instrument (Nr. 77425125, Landis+Gyr)

PDD	Verified Situation	Conclusion
Instrumentation Information		
ID-PDD:	Main meter (OMEPA) at Transelectrica TM-station (220kV)	☑
ID-Internal:	Electricity at the 220 kV high-voltage Transelectrica TM station for turbine 1	☑
Data to be Measured:	Total electricity generation of the turbine 1	☑
Data Logging:	Online monitoring, hourly reading, monthly recording	☑
Archiving of Raw Data:	Connected via modem to the server onsite and further transferred to HQ Hidroelectrica	☑
Measurement Principle:	3 phase quadrant, pulse measurement	☑
Period of Operating Time:	From 25.03.2007 onwards in operation	☑
Instrument Type:	ZMU202C4r41f9	☑
Serial Number:	**Nr. 77425125**	☑
Manufacturer Model Nr.:	Landis + Gyr	☑
Specific Location:	The meter is located at the neighbouring Transelectrica HV TM station in a housing	☑
Measurement Range:	Voltage : (L) 57/100 V ac	☑

	Current : (M) 63.5/110 V ac I n 5 A 1 A I max 10 A 2 A	
Measurement Unit:	MWh	☑
Calibration:	01.07.2003 (IRL 21)	☑
Required Calibration Frequency:	10 years	☑
Uncertainty Level:	0.2 %	☑
Monitoring & Calculation		
Reading Frequency:	hourly	☑
Recording Frequency:	monthly	☑
Trouble Shooting:	n/a	☑

Inspection Results During Verification			
Operation of Instrumentation	Method of Verification	Verification Results	Conclusion
Measuring Principle:	3 phase quadrant digital meter, pulse	The installed electricity meter operates as 3 phase, quadrant digital meter.	☑
Installation:	Installed by the supplier Landis + Gyr	3 phase, quadrant digital meter was installed onsite.	☑
Functionality:	It is referred to the specifications of the supplier.	The meter is installed at the turbine unit at 220 kV high voltage line and was operational.	☑
Quality assurance:	It is referred to the specifications of the supplier.	The calibration certificates were provided.	☑
Maintenance:	It is referred to the specifications of the supplier and the requirements of the grid operator.	No maintenance records were presented so far.	☑
Further Remarks: N/A			☑

3.2.6. Instrument (Nr. 77425126, Landis+Gyr)

PDD	Verified Situation	Conclusion
Instrumentation Information		
ID-PDD:	Main meter (OMEPA) at Transelectrica high-voltage TM-station (220kV)	☑
ID-Internal:	Electricity at the 220 kV high-voltage Transelectrica TM station for turbine 2	☑
Data to be Measured:	Total electricity generation of the turbine 2	☑
Data Logging:	Online monitoring, hourly reading, monthly recording	☑
Archiving of Raw Data:	Connected via modem to the server onsite and further transferred to HQ Hidroelectrica	☑
Measurement Principle:	3 phase quadrant, pulse measurement	☑
Period of Operating Time:	From 17.10.2004 onwards in operation	☑
Instrument Type:	ZMU202C4r41f9	☑
Serial Number:	**Nr. 77425126**	☑
Manufacturer Model Nr.:	Landis + Gyr	☑
Specific Location:	The meter is located at the neighbouring Transelectrica high-voltage TM-station in a housing	☑
Measurement Range:	Voltage : (L) 57/100 V ac (M) 63.5/110 V ac Current : I n 5 A 1 A I max 10 A 2 A	☑
Measurement Unit:	MWh	☑

Calibration:	01.07.2003 (IRL 21)	☑
Required Calibration Frequency:	10 years	☑
Uncertainty Level:	0.2 %	☑
Monitoring & Calculation		
Reading Frequency:	hourly	☑
Recording Frequency:	monthly	☑
Trouble Shooting:	n/a	☑

Inspection Results During Verification			
Operation of Instrumentation	Method of Verification	Verification Results	Conclusion
Measuring Principle:	3 phase quadrant digital meter, pulse	The installed electricity meter operates as 3 phase, quadrant digital meter.	☑
Installation:	Installed by the supplier Landis + Gyr	3 phase, quadrant digital meter was installed onsite.	☑
Functionality:	It is referred to the specifications of the supplier.	The meter is installed at the turbine unit at 220 kV high voltage line and was operational.	☑
Quality assurance:	It is referred to the specifications of the supplier.	The calibration certificates were provided.	☑
Maintenance:	It is referred to the specifications of the supplier and the requirements of the grid operator.	No maintenance records were presented so far.	☑
Further Remarks: N/A			☑

3.2.7. Instrument (Nr. 77425127, Landis+Gyr)

PDD	Verified Situation	Conclusion
Instrumentation Information		
ID-PDD:	Main meter (OMEPA) at Transelectrica TM-station (220kV)	☑
ID-Internal:	Electricity at the 220 kV high-voltage Transelectrica TM station for turbine 3	☑
Data to be Measured:	Electricity measured at the substation (to 220 kV) for turbine 3	☑
Data Logging:	Online monitoring, hourly reading, monthly recording	☑
Archiving of Raw Data:	Connected via modem to the server onsite and further transferred to HQ Hidroelectrica	☑
Measurement Principle:	3 phase quadrant, pulse measurement	☑
Period of Operating Time:	From 04.08.2003 onwards in operation	☑
Instrument Type:	ZMU202C4r41f9	☑
Serial Number:	**Nr. 77425127**	☑
Manufacturer Model Nr.:	Landis + Gyr	☑
Specific Location:	The meter is located at the neighbouring Transelectrica high-voltage TM-station in a housing.	☑
Measurement Range:	Voltage : (L) 57/100 V ac (M) 63.5/110 V ac Current : I n 5 A 1 A I max 10 A 2 A	☑
Measurement Unit:	MWh	☑

Calibration:	01.07.2003 (IRL 21)	☑
Required Calibration Frequency:	10 years	☑
Uncertainty Level:	0.2 %	☑
Monitoring & Calculation		
Reading Frequency:	hourly	☑
Recording Frequency:	monthly	☑
Trouble Shooting:	n/a	☑

Inspection Results During Verification			
Operation of Instrumentation	Method of Verification	Verification Results	Conclusion
Measuring Principle:	3 phase quadrant digital meter, pulse	The installed electricity meter operates as 3 phase, quadrant digital meter.	☑
Installation:	Installed by the supplier Landis + Gyr	3 phase, quadrant digital meter was installed onsite.	☑
Functionality:	It is referred to the specifications of the supplier.	The meter is installed at the turbine unit at 220 kV high voltage line and was operational.	☑
Quality assurance:	It is referred to the specifications of the supplier.	The calibration certificates were provided.	☑
Maintenance:	It is referred to the specifications of the supplier and the requirements of the grid operator.	No maintenance records were presented so far.	☑
Further Remarks: N/A			☑

3.2.8. Instrument (Level meters, TLN)

PDD	Verified Situation	Conclusion
Instrumentation Information		
ID-PDD:	TLN	☑
ID-Internal:	Not specified	☑
Data to be Measured:	Level of the river Danube, upstream and downstream the turbines	☑
Data Logging:	Continuously	☑
Archiving of Raw Data:	Transfer via modem to the server at the plant and at Hidroelectrica HQ Turnu Severin	☑
Measurement Principle:	Floating device	☑
Period of Operating Time:	From 2003 onwards in operation	
Instrument Type:	Teleimnimeter	
Serial Number:	N/A	
Manufacturer Model Nr.:	Not specified	
Specific Location:	Upstream and downstream of the dam	
Measurement Range:	N/A	
Measurement Unit:	m	☑
Calibration:	The reliability of the level meters is checked every 6 month by the common Serbian Romanian technical committee and the results are included in to the bi-annual commission report (IRL 19).	☑

Required Calibration Frequency:	6 months	
Uncertainty Level:	0.15 %	
Monitoring & Calculation		
Reading Frequency:	hourly	☑
Recording Frequency:	hourly	☑
Trouble Shooting:	Not reported for this monitoring period.	☑

Inspection Results During Verification			
Operation of Instrumentation	Method of Verification	Verification Results	Conclusion
Measuring Principle:	In compliance with meth./PDD	Not specified	
Installation:	installed	The position could be verified onsite	
Functionality:	In operation	The functionality could be verified onsite	
Quality assurance:	Calibration		
Maintenance:	Description		
Further Remarks: N/A			

3.3. Sampling Information (not relevant)

3.4. Accounting information (not applicable)

PDD	Verified Situation	Conclusion
Accounting Information		
ID-PDD:	n.a.	☑
ID-Internal:	n.a.	☑
Description of Accounted Compo-nent:	n.a.	☑
Accounting Unit:	n.a.	☑
Quality Assurance Measures / Sys-tem:	n.a.	☑
Account Archived:	n.a.	☑
Account Credible / in Line with PDD:	n.a.	☑
Further Remarks: N/A		☑

3.5. External Data

PDD	Verified Situation	Conclusion
External Data		
ID-PDD:	Level, Head	☑
ID-Internal:	Not specified	☑

Description of Data / Data Refers to:	The upstream and downstream levels of the Danube river at the PdF I are measured for the calculation of net head and the energy.	☑
Unit of Data (if appropriate):	m	☑
Date of Data Income:	continuous	☑
Source of Data:	TLN measurements	☑
Reliability of Data Source:	Calibration (IRL 19)	☑
Is the Data up-to-date?	Yes	☑
Uncertainty Level:	0.15 %	☑
Further Remarks: N/A		☑

PDD	Verified Situation	Conclusion
External Data		
ID-PDD:	**η** Turbine efficiency factor	☑
ID-Internal:	Not specified	☑
Description of Data / Data Refers to:	The turbine efficiency has been improved due to the replacement of turbine blades. It is calculated according the model developed by ASTRÖ.	☑
Unit of Data (if appropriate):	%	☑
Date of Data Income:	ASTRÖ report,	
Source of Data:	ASTRÖ report	See above

Reliability of Data Source:		See above
Is the Data up-to-date?		See above
Uncertainty Level:	Max ± 0.27, min ± 0.17 and repeatibility 0.1%	See above
Further Remarks:		See above

PDD	Verified Situation	Conclusion
External Data		
ID-PDD:	Pr, Energy of the refurbished unit (measured hourly)	☑
ID-Internal:	Not specified	☑
Description of Data / Data Refers to:	The generated total electricity is recorded and cross checked by various meters (see chapter 3.2). These data cannot be used, because it does not record the additional energy increase separately. Only the hourly recorded Energy (Pr) is relevant for further calculations.	
Unit of Data (if appropriate):	MWh	☑
Date of Data Income:	see chapter 3.1 and 3.2	☑
Source of Data:	Various meters onsite and at the substation See also 3.1 and 3.2	☑
Reliability of Data Source:		☑
Is the Data up-to-date?		☑
Uncertainty Level:	0.2 %	☑
Further Remarks: N/A		☑

3.6. Others (not applicable)

PDD	Verified Situation	Conclusion
Others		
ID-PDD:	n.a.	☑
ID-Internal:	n.a.	☑
Description of Component:	n.a.	☑
Unit of Component (if appropriate):	n.a.	☑
Date Component:	n.a.	☑
Source of Component:	n.a.	☑
Reliability of Source:	n.a.	☑
Up-to-date?	n.a.	☑
Uncertainty Level:	n.a.	☑
Further Remarks:		☑

4 Data Verification

4.1 Internal Review

Description and performance of internal review			
	Description	Comments	Concl.
Procedure	According to Annex 5 of the MP. The data recorded at the Control room in PdF 1 are checked and validated in the headquarter of Hidroelectrica from Turnu Severin, by the Dispatcher.	Internal review procedures (OP) as part of the existing QM systems are implemented on the data management system (IRL 8).	☑
Documentation	See remarks above		
Responsibilities	Mr. Dragos Novac is performing the final check of the MR.	Mr. Emil Sopotă – Department for Monitoring the Hydrotechnical Construction has been named as the responsible staff for internal check of the teleimnimeters.	☑
Further Remarks: N/A			

4.2 Usage of default values (not applicable)

4.3 Reproducibility

Description and performance of the assessment			
	Description	Comments and Results	Concl.
Procedure	The audit team assessed the consistency and reproducibility of the calculated results. Due to the huge collected data chain, it has been not possible to recalculate all results for cross check	The calculation program used by the project participant (FORTRAN) is a way of handling the huge amount of data in a short calculation time. A simple program (EXCEL) is used for an easy follow-up of the results (cross-check).	☑
Further Remarks: N/A			

4.4 Peculiarities

Description of Peculiarities and unexpected Daily Events during the verification period			
	Description	Comments and Results	Concl.
Performance	During the verification period the facility was running There were no special events during this monitoring period other than scheduled maintenance activities.	As checked with the documents provided (IRL 18) there were only minor events with no real impact on the project. The total availability of the turbines was more than 90% of time. **Clarification Request No.1** An explanation regarding the low energy production during the year 2011 is requested.	CL1
Documentation	Turbine logs		☑
Measures	N/A		
Further Remarks: N/A			

4.5 Reliability and Plausibility

Description of crosschecks and plausibility checks			
	Description	Comments and Results	Concl.
Performance	The data are plausible and no faulty founded. No discrepancies from the normal trend were found.	The procedures as included in Annex 5 to the MP are in place at the Plant.	☑
Further Remarks:	No further remarks		

4.6 Completeness and Correctness

Description of completeness and correctness			
		Comments and Results	Concl.
Correctness	All data provided is correct. The data is collected automatically in the control room of the SH PdF 1 and simultaneously entered in the PC of the Dispatch Office from Drobeta Turnu Severin. In the same time the data is sent to the Serbian part for cross-check.	The information included in the work-book has been cross-checked with monthly logbooks (IRL 24) and by random daily checks for: • 2008: February 22, h=19, August 23, h=10, October 01, h=24 • 2009: January 25, h=17, March 01, h=13, December 25, h=19 • 2010: May 25, h=12, June 26, h=24, August 27, h=15 • 2011: January 15, h=14, July 28, h=10, November 22, h=22 All data checked were found to be corrected collected, calculated and stored	☑

		and further interpreted as for CO2 emission reduction purposes.	
Completeness	All data provided is complete. They are presented in the electronic workbook.	No	☑
Further Remarks: No further remarks			

5 Additional requirements (not relevant)

6 Data Reporting

Description of the Monitoring Report		
	Comments and Results	Concl.
Compliance with UNFCCC regulations	The monitoring report for this verification audit follows the CDM MR template of UNFCCC. The verification period covers 2008 - 2011.	☑
Completeness and Transparency	The verification data consists of : - reading protocols for power and head - calculation workbook of the turbine efficiency using power and head The data analysed were complete and transparently presented.	☑
Correctness	**Corrective Action Request No.2** - All grammar mistakes, formal mistakes, typos, inconsistencies and non-conservative assumptions	CAR2 CAR3

	have to be revised in the MR. **Corrective Action Request No.3** The grid EF for 2010 is different compared with the same EF as included in the MP (799 and 800). Correction is requested. The ERUs calculation shall be corrected also. **Corrective Action Request No.4** In the documents "E_200x": - Title is missing - The parameters Ebr and Enet are not defined - URE is used for emission reduction (English) The data presented in Excel files are not transparent Correction is requested. **Corrective Action Request No.5** There is no header with data/units in the Excel files Correction is requested. **Corrective Action Request No.6** Chapter E.6 shall be revised considering only the difference between ex-ante values estimated in the MP ver.1 dated October 2007 and Project values.	CAR4 CAR5
Further Remarks: See CAR #1,2,3,4,5,6		

7Compilation and Resolution of CARs, CRs and FARs for PdF 1

Corrective Action Request by audit team	Summary of project owner response	Audit team conclusion
Corrective Action Request No.1 On the first page of the MRs a date and a version number shall be included.	The new Monitoring Reports include on the first page: Version 2, July 19, 2012	Confirmed, IRL 26. **This issue is closed**.
Corrective Action Request No.2 - All grammar mistakes, formal mistakes, typos, inconsistencies and non-conservative assumptions have to be revised in the MR	The MRs have been revised accordingly.	Corrections have been made, as checked in the new Monitoring Reports (IRL 26): - Wording at page 7 - The “netto value” corrected in MRs 2009-2011 - Table at page 7 (MRs for 2010 and 2011) – the sum-up is corrected - Table at page 5 – meter identification is correct (TH) - The yearly ERUs values are rounded - The SI units and abbreviations are correctly used - A legent has been included at page 3 for identification of the scheme - The year 2012 has been ex-

		cluded from calculations - In the table with meters calibration has been indicated the date of the last calibration performed - The correct estimations for ERs, as included in the Monitoring Plan rev. 2 are used in the calculations - The discussion presented in Chapter E.6 regarding the revision of the monitoring methodology has been deleted - Chapter E.5 has been reviewed - In Chapter E.1 the formula for baseline calculation is now included - The monitoring parameters are now consistent with MP **These issues are closed.**
Corrective Action Request No.3 - The grid EF for 2010 is different compared with the same EF as included in the MP (799 and 800). Correction is requested. The ERUs calculation shall be corrected also.	The Monitoring Reports, Version 2, July 19, 2012, include the requested correction.	The grid EF for 2010 is correct in the new MRs ver. 2 (IRL 26). **This issue is closed**.

Corrective Action Request No.4 In the documents "E_200x": - Title is missing - The parameters Ebr and Enet are not defined - URE is used for emission reduction (English) The data presented in Excel files are not transparent Correction is requested.	The "E-200x" files include a title and were corrected. The parameters Ebr and Enet are defined in the new version of the Monitoring Report.	Corrections have been made, however: **Corrective Action Request No.7** 1. The Excel calculation files have the same name as the initial ones. A version number shall be included in the name of the files 2. The hour "1" from 01/01/yyyy is missing 3. Definition of the parameters ηref and ηext is missing 4. η1 is used also for HG 2 and HG 3 **This issue is not closed.**
Corrective Action Request No.5 There is no header with data/units in the Excel files Correction is requested.	The new excel files include a header with data/units	The new excel files include a header with data/units (IRL 27), however see above.
Corrective Action Request No.6 Chapter E.6 shall be revised considering only the difference between ex-ante values esti-mated in the MP ver.1 dated October 2007 and Project values.	The Monitoring Reports, Version 2, July 19, 2012, include the requested correction	The Monitoring Reports, Version 2, July 19, 2012, is corrected. **This issue is closed**.

Corrective Action Request No.7 1. The Excel calculation files have the same name as the initial ones. A version number shall be included in the name of the files 2. The hour "1" from 01/01/yyyy is missing 3. Definition of the parameters ηref and ηext is missing 4. η1 is used also for HG 2 and HG 3	The "E-200x" files were renamed and the new file name includs "ver 02". The hour "1" from 01/01/yyyy were included and the parameter η were corrected accordingly the HG. ηref – is the efficiency for the refurbished turbine ηext – is the efficiency for the existing turbine before refurbishment	The new excel files (IRL 29), were corrected. **This issue is closed**.
Clarification Request by audit team	**Summary of project owner response**	**Audit team conclusion**
Clarification Request No.1 An explanation regarding the low energy production during the year 2011 is requested.	During 2011 the flow on Danube was were low, respectively 4209 m^3/s comparing with the median streamflow for Danube of 5520 m^3/s ; 2011 was a very dry year	The explanation is clear. **This issue is closed.**

Industrie Service

Annex 2: Information Reference List

Information Reference List	2012-11-14	Periodic Verification of the JI track 1 Project: “Modernisation of 3 hydro units in Portile de Fier I Hydro Station” Information Reference List	

Ref. No.	Issuance and/or submission date (dd/mm/yyyy)	Title/Type of Document	Author / Editor / Issuer	Additional Information (Relevance in JI Context)
1	July 2002	Baseline Study	KPMG	
2	24/07/2001	Electricity Generation License issued for the refurbished new capacity in hydropower plant PdF I	ANRE	
3	2007	Procedures for using Joint Implementation (JI) mechanism under Track I (National JI Track I Procedure)	Government of Romania	
4	March 2008	Monitoring Plan of JI project “Modernisation of 3 hydrounits in Portile de Fier I hydro station”	Hidroelectrica	
5	21/11/2008	Determination Report of JI project “Modernisation of 3 hydrounits in Portile de Fier I hydro station”, Report No.1068445a, Revision 2	TÜV SÜD	
6	25/03/2009	Monitoring Reports of JI project “Modernisation of 3 hydrounits in Portile de Fier I hydrostation” for the monitoring period 2008 to 2011	Hidroelectrica	
7	11/2006	“Topogeodetic works for Level Reference, 11/2006 by Hidroelectrica (IRL 16 of the Determination Report)	Hidroelectrica	Level meters accuracy
8	06/04/2010	Decision N.439 by Hidroelectrica regarding the implementation of the project activities PdF I with ERU 01/01 and PdF II with ERU 03/17	Hidroelectrica	
9	02/04/2009	QA_QC Operational and Management Chart. Annex 5 to MP Portile de Fier I : Flow scheme of the monitoring process with data acquisition and archiving steps OPERATIONAL AND MANAGEMENT STRUCTURE	Hidroelectrica	
10	26/06/2009	Certificates on implemented QM systems ISO 9001, ISO 14001 and ISO 18001, validity: 26/06/2012	Hidroelectrica	

11	19/08/2008	Maintenance Contract with Hidroserv	Hidroelectrica	
12	March 2008	Annex 6 to MP Portile de Fier I : Statistical adjustment procedure of the output data to operational conditions	Hidroelectrica	
13	March 2008	Annex 7 to MP Portile de Fier I : Description of the monitoring parameters of the project activity	Hidroelectrica	
14	28/02/2012	Annex 1_2_Energy_Protocols_OMEPA (grid operator) - Monthly reports signed by the Grid operator and the PdF I staff in charge : - Supplied electricity to the grid for each individual turbine unit at 220 kV - Purchased electricity from the grid for each individual turbine unit at 220 kV	Hidroelectrica, Transelectrica	PdF I and PdF II
15	28/02/2012	Cross_check_meters_(OMEPA_internal_meters) SCADA data output on electricity data records at the internal (ABB/PdF I) and external (OMEPA/Transelectrica) meters for cross check “Diferente zilnice dintre sistemul OMEPA si ABB PFI 2008-2011.xlsx»	Hidroelectrica	
16	28/02/2012	Cross_check_energy_Romania_Serbia Bi-annual report on generated electricity data cross check for the Serbian-Romanian commission (2008 – 2011) Folders “Sesiunea 077_2008” …”Sesiunea 084_2011”	Hidroelectrica	
17	28/02/2012	Annex 1_1_Calibration_(and meter scheme) Single line diagramme with the positioning of the meters, “schema_contori_pf1.pdf” and calibration certificates for old and new meters	Hidroelectrica	
18	28/02/2012	Turbine History data on operation, breakdown and maintenance periods for 2008 – 2011 “ANEXA1008(turbine log).doc”…” ANEXA1011(turbine log).doc”	Hidroelectrica	
19	28/02/2012	Annex 1_3_Level_meters_calibration Technical summary on the functionality of the water level-meters (“telelimnimetru”)	Hidroelectrica	Level meters calibration for the period 2008
20	2012	http://www.anre.ro/documente.php?id=395	ANRE	
21	28-02-2012	Working Procedures Romania/Serbia (SCDE). Attachement to Annex 5 of MP	Hidroelectrica	JI Procedures

22	28-02-2012	PO-HE-PF-138 Catalogare codificare achizitie echipam tehn calcul ed5 rev0	Hidroelectrica	
23	28-02-2012	PO-HE-PF-190 Gestionare materiale utilaje trimise rep la terti ed2 rev0	Hidroelectrica	
24	28-02-2012	Print screens for 28/03/2012: «date instantanee PF1 si PF2.docx»	Hidroelectrica	
25	28-02-2012	Annex 1_4_Calculation 2008 (9,10,11)pf1(2).xls	Hidroelectrica	Excel calculation of ERUs
26	19.07.2012 to 05.11.2012	Monitoring Reports of JI project “Modernisation of 3 hydrounits in Portile de Fier I hydrostation” for the monitoring period 2008 to 2011, ver. 2, dated 19.07.2012 Monitoring Reports of JI project “Modernisation of 3 hydrounits in Portile de Fier I hydrostation” for the monitoring period 2008 to 2011, ver. 3, dated 26.09.2012 Monitoring Reports of JI project “Modernisation of 3 hydrounits in Portile de Fier I hydrostation” for the monitoring period 2008 to 2011, ver. 4, dated 05.11.2012	Hidroelectrica	
27	19-07-2012	2008(9, 10, 11)pf1.xls	Hidroelectrica	Excel calculation of ERUs
28	19-07-2012	E2008(9, 10, 11) energy values PdfI.pdf	Hidroelectrica	
29	21-08-2012	2008(9, 10, 11)pf1 ver 02.1.xls	Hidroelectrica	Final Excel calculation of ERUs

	28/02/2012-01/03/2012 (Turnu Severin) and 27/02/2012, 15/03/2012 (Bucharest)	On-site interviews conducted in Dr. Turnu Severin, Romania at Hidroelectrica S.A: headquarters by auditing team of TÜV SÜD **Verification Team:** Mr. Constantin Zaharia GHG auditor, TÜV SÜD **Interviewed persons at SH Portile de Fier I and II, Romania** Mr. Dragos Novac Technical Director – SH Portile de Fier Mr. Christian Bocse Manager SEME– SH Portile de Fier Mrs. Dana Horhoianu Environmental Adviser– SH Hidroelectrica Mrs. Mereuta Dumitra Environmental Director– SH Hidroelectrica Mr Ciprian Rachitan Metering responsible , SH Portile de Fier Mr Danut Caplea STIC, SH Portile de Fier Mr. Vuc Remus Dispacher SH Portile de Fier II Mr. Paraschivoiu Mitica technician, SH Portile de Fier II **Abbreviations:** ANRE Energy Market Regulatory Authority, Romania ASTRÖ Anstalt für Strömungsmaschinen GmbH, Austria CEZ Regional grid operator in charge of PdF II EPFL Ecole Polytechnique Federal Lausanne OMEPA National Operator in charge of Electricity Metering and Accounting Transelectrica National Grid operator, Romania	TÜV SÜD	