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Verification Report

S.C. Hidroelectrica S.A.

Second Periodic Verification of the JI Track 1 Project

“Modernisation of 4 hydro units in Portile de Fier II power station ”

Monitoring period: 01-01-2012 to 28-11-2012

Report No. 600501138

20 December 2012

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

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Subject:			Second Periodic Verification of the JI Track 1 project "Modernisation of 4 hydro units in Portile de Fier II power 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 RO1000204 on: http://ji.unfccc.int/JIITLProject/DB/ZIBKFP9MMVOE1NSKT8HW1CQR928OF4/details	
Monitoring period:			01-01-2012 to 28-11-2012	
First Monitoring Report (version/date)			Version 1.0 / 29-11-2012	
Final Monitoring Report (version/date)			Version 2/ 05-12-2012	

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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 second periodic verification of the registered JI Track-1 project "Modernization of 4 hydro units in Portile de Fier II power 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. 1068445b, Revision 2, determination date 14-11-2008), Monitoring Plan rev. 1, dated March 2008 with Annexes 5, 6 and 7 and the Baseline Study performed by KPMG in 2003. 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. 1, 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 period are in a reasonable range to the values indicated in the Monitoring Plan thus: MP estimation: 48,676 t CO_2e (reduced at the period 01/01/2012 to 28/11/2012) and Monitoring period: 32,907 t CO_2e. Hence the realized ERUs are 32% lower than estimated in MP.

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

Reporting period: from 01/01/2012 to 28/11/2012

Verified emission in the above reporting period:

Total Emission reductions: **32,907** t CO_2e.
(Project and Leakage Emissions are 0)

Assessment Team Leader: Robert Mitterwallner **Assessment Team Members:** Constantin Zaharia	**Technical reviewer :** Thomas Kleiser **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_2,e	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	1.1	
Determinated Report: Baseline Study	TÜV SÜD Determination Report No. 1068445b, Revision 2, dated 14-11-2008 KPMG, 2003	
Monitoring Plan:	02-03-2008, aproved by Romanian DFP in December 2010	
	Version	Date
Published Monitoring Report	1.0	29-11-2012
Revised Monitoring Report	2	05-12-2012
Project documentation link:	UNFCCC: http://ji.unfccc.int/JIITLProject/DB/ZIBKFP9MMVOE1NSKT8HW1CQR928OF4/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 "Modernization of 4 hydro units in Portile de Fier II power station".

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 re-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-1000204. 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:	"Modernization of 4 hydro units in Portile de Fier II power station"
DFP registration number:	**RO1000204**
UNFCCC link:	http://ji.unfccc.int/JIITLProject/DB/ZIBKFP9MMVOE1NSKT8HW1CQR928OF4/details
Project Participants:	S.C. Hidroelectrica S.A. (project owner) SenterNovem (now : Agentschap NL)
Location of the project:	Ostrovul Mare, Romania N:44° 18' 30'',E:22° 34'(Latitude 44.30°,Longitude 22.56°)
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 II Hydro Station (in the following: PdF II) in Romania and supply the generated electricity in to the public grid. The PdFII hydro power plant is situated at Km 863 + 358 on the river Danube 60 km downstream of the city of Drobeta Turnu Severin, Romania. The initial hydro power project Portile de Fier II was developed and implemented by the Romanian and Yugoslavian authorities and became operational in 1985. The whole power plant complex is managed by the joint Serbian-Romanian commission. It consists of 2 identical parts, 8 turbine units on the Serbian side and 6 units on the Romanian side, each with a rated capacity of 27 MW. Besides this hydropower complex, two additional units are installed and

operational in the power plant Gogosu, at the Romanian side, which is not part of this project activity.
The 8 turbine-generator units on the Portile de Fier II hydro power station were refurbished from the initial 27 MW rated capacity up to 31 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 four turbine-generator units on the Portile de Fier II hydro power station, HG 3, HG 4, HG 5 and HG 7.

The implementation status of the project in the verification period is presented in the table below:

Turbine Unit	Commissioning of the refurbished Turbine Unit
HG 3	12.01.2007
HG 4	21.12.2005
HG 5	24.01.2008
HG 7	06.03.2009

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 fulfilment 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 on-site visit took place in 04/12/2012.

The verification team consisted of the following members:

Name	Qualification	Coverage of scope 1	Coverage of technical area 1.1	Host country experience
Robert Mitterwallner	**ATL**	☑	☑	☑
Constantin Zaharia	Verifier			☑

The verification team on-site: Constantin Zaharia. Robert Mittewallner participated in a conference call with the PP on 04/12/2012.

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 is appointed as Auditor for Renewable Energy Certification.

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

Thomas Kleiser Technical Reviewer

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 depicted in the registered Determination Report. 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 04/12/2012, 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 Plan (IRL4)
- Monitoring report (IRL6)
- Raw data (IRL13)
- Data from cross-check instruments (IRL14-IRL15)
- Quality assurance and quality control documents (IRL8, IRL9)
- Calibration documents (IRL16)

Sufficient evidences and data covering the full verification period in the required frequency is available to validate the figures stated in the final MRs. 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 re-determined project design documents, the Determination Report, and the final Monitoring Reports (version 2, submitted on 05/12/2012). The verification findings for each verification subject are presented below.

3.1 FARS FROM THE FIRST VERIFICATION

There is no FAR from the First Periodic Verification

3.2 Project Implementation in accordance with the re-determined Project Design Documents

The project is implemented according to the final Monitoring Plan, incl. annexes. The refurbished turbine unit HG5 was re-started on 24-01-2008 and the refurbished turbine unit HG7 was re-started on 06-03-2009.
The Project consists of:

- Replacement of blades at turbine-generator units HG3, HG4, HG5 and HG7 at the PdF II hydro station as to increase electricity generation capacity (refurbishment)
- Turbine efficiency increase achieved by the refurbishment works

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 11-01-2007, as was confirmed during on-site visit.

In the monitoring period 01/01/2012 to 28/11/2012, the result of the emission reductions with 32,907 t CO_2,e differs from the estimated value of 48,676 (calculated for the time period 01/01 – 28/11/2012) t CO_2,e in the final Monitoring Plan dated 02-03- 2008 because 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 the specific year.

The following table summarizes the difference between MP estimations and Project emissions:

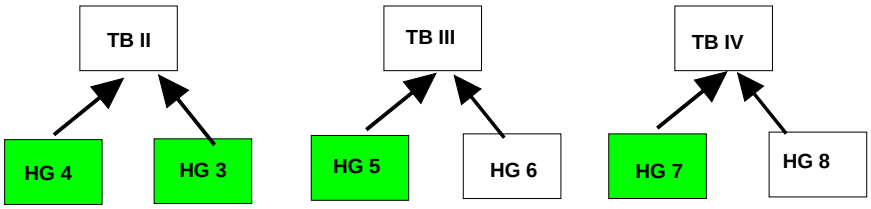
Year	**2012**
CEF (tCO_2/GWh)	763*
ERU (t CO2)	48,676**
ERU (tCO_2) realised	32,907

* CEF values were fixed ex-ante in the approved Monitoring Plan
** reduced to the time period 01/01/2012 – 28/11/2012

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 1% of the total energy produced. The net electricity measured at the 110 kV high-voltage TM station :" Stația 110/20/6 KV Ostrovul Mare, calibrated and maintained by Elster Rometrics S.R.L. in accordance with the regional grid operator CEZ, are used as back-up in case of failure of a turbine meter together with the correspondent meter of the turbine – see below. Data from TB meters are contained in the monthly protocols signed by the Hidroelectrica and the grid operator Transelectrica (represented by the regional grid operator SC CEZ Distributie COMC SA). Data from HG meters are automatically sent to the Serbian part and checked twice per year during the official meetings.
Source of data used:	The scheme below presents the meter connection. With green colour are the Project units.  The net electricity measured at the 110 kV high-voltage TM station :" Stația 110/20/6 KV Ostrovul Mare", (TB I, TB II and TB III) is the data source used for back-up. Following data sources were used : - net electricity data recorded at meters on 110 kV HV line (CEZ) - raw data recorded at the meters at the turbine-generator units (Hidroelectrica) - SCADA data recorded and archived at Hidroelectrica HQ in Turnu Severin The metering equipment used has been calibrated according to the requirements of the approved monitoring plan, e.g. the meters are checked by the company Elster Rometrics S.R.L. in accordance with the regional grid operator CEZ. CEZ acts for the grid operator Transelectrica and is in charge of the maintenance and calibration of the metering devices. 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 : E_A +E_B E_A = Ea + Eb - Ea : Additional electricity achieved by the refurbishment of the turbine blades. Ea is determined with the hourly measured Electricity

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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 EPFL.
- E_B : Additional electricity achieved by the enhanced energy potential in the entire Portile de Fier cascade following the refurbishment works and the elevation of the head at PdF II. Only ¼ of the E_B is considered in the final balances, because ½ of E_B is attributed to the power complex on the Serbian side of the cascade, ½ of the remaining amount is considered for 4 of the total 8 units at PdF II.

Cross-check

The electricity output of the turbine-generator units is measured with the meters installed at the turbine. The measured electricity at the 110 kV Transelectrica (CEZ) 110 kV TM station is measured by CEZ in accordance with the national grid operator Transelectrica..
The electricity data recorded by the meters at the 110 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 1 % and therefore within the approved uncertainty level.
The meters situation is presented in the table below:

Meter	Parameter	Serial number	metrological verification report	
			Number/last calibration	Validity (years) Calibration date
HG3 (G3)	Energy produced (main)	2698070	152737	8 23.11.2006
HG4 (G4)	Energy produced (main)	2685387	2195790	8 10/09/2010*
HG5 (G5)	Energy produced (main)	2709048	1529289	8 26/09/2007
HG7 (G7)	Energy produced (main)	2720905	2192291	8 15/01/2009
HG6	Energy produced (backup)	5010056	2685388	8 08.06.2012**
HG8	Energy produced (backup)	2698069	0152737	8 23/11/2006***
TB II	Energy delivered 110kV block II Unit #3 and #4 (backup)	5013693 2716747	1520283 01531152	10 07/11/2002 8 15.07.08***
TB III	Energy delivered 110kV block III Unit #5 and #6 backup)	5013695	1520664	10 14/02/2003
TB IV	Energy delivered 110kV block IV Unit #7 and #8 (backup)	5013692	0152739	10 23/11/2006****

* calibrated on 10.09.2010 and installed on 28.09.2010

	** between 30.05 2011 – 05.07.2012 the unit HG 6 has been out of operation *** calibrated on 15.07.2008 and installed on 06.11.2012 **** calibrated on 23.11.2006 and installed on 10.04.2009 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% as per manufacturer specification. The cascade effect is subject to bi-lateral cross-check between Romania and Serbia.

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 32).
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 EPFL.
Means of verification/Comments:	According to the applied calculation model, the water levels are monitored continuously; they are read hourly and recorded monthly. The difference between upstream and downstream level data results in the Head. The hourly data (IRL 25) included in the workbook has been verified with data in the monthly logbooks (IRL 13) and by random daily checks (see Annex 1). AIE confirms that the data management is in compliance with para. 101 of the DVM.
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 II. The cross-check by Romanian and Serbian authorities is continuous. The annual calibration of the devices is performed by geodesic measurements led by the common technical staff of both sides. Together with the total electricity production data, the head is included also into the regular bi-annual reports and cross checked in meetings (IRL 18).

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 EPFL (Ecole Federal Polytechnic Lausanne). The efficiency factors in the unfurbished 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 EPFL has developed a simulation model for the refurbished turbines. The model data for the reference (non-furbished) 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 EPFL. The hourly determined head / power data pair is used to read the efficiency

	factors under refurbished and non-furbished 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). The hourly data (IRL 25) included in the workbook has been verified with data in the monthly logbooks (IRL 13) and by random daily checks (see Annex 1). AIE confirms that the data management is in compliance with para. 101 of the DVM.
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. The company Hidroelectrica has a certified quality and environmental management system (ISO 9001, ISO 14001, ISO 18001) (IRL 9), 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 verification period (01-01-2012–28-11-2012).

The calculations are based on a FORTRAN programme. The verification team performed spot checks for the whole monitoring period 01-01-2012–28-11-2012 - see the Annex 1 - Verification Protocol). Moreover, any value of the excel documents can be traced back using the information for "Head", "Power" and EPFL model – "EPFL-LMH Test report Tests No. 472/473 on bulb turbines at PdF II". The algorithms and formulas of the Fortran program have been checked during on-site visit by spot checks, (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.

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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. 1 dated October 2007. The reason is that the estimated values are calculated with the energy produced in the average hydraulic year and in fact 2012 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:
In the MR, page 11, it's mentioned that the lower than estimated in PDD, ERUs for the year 2012, are due to the hydrology in the year 2012. This statement shall be elaborated in more details and normal/year 2012 flows for Danube river shall be explained also.

CAR 1 means of verification

The verification team received the following explanation regarding Danube flow:
"The differences occur due to the hydrology on the Danube in this specific year, which was a very dry year, like illustrated in the table below for each month of 2012:"

Month	Multiannual average flow	Flow in 2012	2012/average
1	4687	3798	0.81032643
2	4971	3155	0.63468115
3	6455	5567	0.86243222
4	7751	6069	0.78299574
5	7492	6047	0.8071276
6	6473	5753	0.88876873
7	5423	3836	0.70735755
8	4396	2863	0.65127389
9	3892	3073	0.78956835
10	3926	3199	0.81482425
11	4685	4708	1.00490928
average	5468	4370	0.79584229

The explanation has been considered clear.

CAR 1, changes in the MR or related documents

N/A

Corrective Action Request 2:
The MR shall include on the first page the exact time duration of this second monitoring period: 01/01/2012 to 28/11/2012.

CAR 2, means of verification

The audit team checked the new version of the MR version 2 (IRL 6) and confirms that the title

is in line with the monitoring period.
CAR 2, changes in the MR or related documents
MR has been updated to version 2.

Clarification Request 1: **1.** Some meters – see the meter YWG 005 013 693, - have 10 years required calibration frequency. Others (QWG002698069, for ex.) have 8 years. An explication for different calibration frequencies is requested. The legal requirement for the meter calibration frequency is also requested. **2.** Evidence that Senter Novem, the initial buyer of the ERUs, is now part of the NL Agency is requested.
CR 1, means of verification
1. Since 2001 till 2012 the legislation regarding the metrology verification was changed as follows: 2001 - Order no. 144 of RBLM established in annex 1 position L81 a periodicity of verification for energy meter of 10 years 2004 – Order no.27 of the Romanian Bureau of Legal Metrology (RBLM) established in annex 1 position L81 a periodicity of verification for energy meter of 5 years; 2010 – Order no.48 of RBLM established in annex 1 position L81 a periodicity of verification for energy meter of 8 years 2012 – Order no. 148 of RBLM established in annex 1 position L81 a periodicity of verification for energy meter of 10 years. The verification team checked the RBLM documents and confirmed the changes in the calibration frequency. 2. The TÜV SÜD assessment team received the following message from Mrs. Boschma, Sietske: "NL Agency came about in early 2010 through a merger of EVD, Netherlands Patent Office (Octrooicentrum Nederland) and SenterNovem. This merger will soon allow us to be of even better service to you as a result of a collective focus: one customer support desk, coherent programmes, better coordinated financing programmes and transparent, short procedures"
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 second periodic verification of the JI track 1 project: **"**Modernization of 4 hydro units in Portile de Fire II power 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 units HG3, HG4, HG5 and HG7 are 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, 2012 to November 28, 2012

Total Emission Reductions (ERU): **32,907** t CO_2e

Munich, 20-12-2012

Thomas Kleiser
Certification Body "climate and energy"
TÜV SÜD Industrie Service GmbH

Munich, 20-12-2012

Robert Mitterwallner
Assessment Team Leader

Industrie Service

Annex 1: Verification Protocol

Verification Protocol

Project Title: Modernization of 4 hydro units in Portile de Fier II power station, Romania

Date of Completion: 20 December 2012

Number of Pages: 55

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Project Activity Implementation

1.1. Technology

PDD	Verified Situation	Conclusion
Location (s)		
Description / Address: The project Portile de Fier II is located on the island Ostrovul Mare at the Danube river 60 km downstream of the city Drobeta Turnu Severin. The large hydropower plant Portile de Fier II consists of 8 turbine + generator units. The refurbished (new turbine blades) turbine units No. 3, 4, 5 and 7 are considered within the project boundary "CO_2 reduction by modernization of 4 hydro units within Portile de Fier II". The purpose of the project is to increase the installed power and the efficiency of the existing units No. 3, No. 4, 5 and 7 and reduce the fossil fuel power generation.	The project site has been visited on 04 December 2012. The turbine + generator units and corresponding measuring and maintenance equipment were checked and documented (print screens). The operational control center within the plant has been visited. Furthermore the HV TM-station (operated and maintained by CEZ) has been entered for meter readings.	☑
GPS coordinates:	N: 44° 18' 30'', E: 22° 34'	☑

PDD	Verified Situation	Conclusion
Technical Equipment – Main Components		
Component 1 : ***Turbine unit HG 4*** Horizontal bulb type turbine	The refurbished unit No.4 was commissioned on 21.12.2005.	☑
Technical Features *Turbine unit HG 4* The original installed capacity of the turbine unit 3 (27 MW) was increased to 31.4 MW after refurbishment, The type of the refurbished turbines is KOT 32-7,80 – horizontal Kaplan turbines. The maximum power is 32.5 MW. Maximum water flow for electricity production is 475 m^3/s (earlier 425 m3/s). *Generator HG 4 :* The generator was refurbished by ABB..	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 425 m3/s to 475 m3/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). The generators are all identical. The generators are capsulated, synchronous horizontal of bulb type, directly coupled to the hydraulic driving turbines. The type is IM 5402 (A4). Design power 32.00 MVA. Voltage: 6.3 kV. Current: 2933 A. Rotation speed: 62.5 rot/min. 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 close circuit (water + heat exchangers).	☑
Component 2 : ***Turbine unit HG 3***	Similar with HG 4	☑

PDD	Verified Situation	Conclusion
Component 2 : *Technical Features* *Turbine HG 3* *Generator HG 3*	The refurbished turbine unit No.3 was set in operation on 12.01.2007.	☑
Component 3 : ***Turbine HG 5*** see description for No. 4	The turbine unit No.5 was set in operation by 24.01.2008.	☑
Component 3 : *Technical Features* *Turbine HG 5 :* see description for turbine No. 4 *Generator HG 1*	.	☑
Component 4 : ***Turbine HG 7***	The turbine unit No.7 was set in operation by 06.03.2009.	☑
Component 4 : *Technical Features* *Turbine HG 7 :* *Generator HG 7*	Similar with HG 4	☑

PDD	Verified Situation	Conclusion
Operation Status during verification		
Approvals / Licenses N/A	The operation of the refurbished units and the supply of the additional generated energy into the grid was approved by ANRE licence issued on 24.07.2001 and updated on 08.07.2005. Validity period 25 years.	☑
Actual Operation Status N/A	Under construction ☐ In operation ☒ 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. 3, 4, 5, 7 for the whole crediting period 01/012012 – 28/11/2012 has been provided to the verification team IRL (17). Overflow has been documented for each of the monitoring period 01/012012 – 28/11/2012 (IRL 15 – Sesiunea 85 - 86). (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 for the calculation of ERUs . 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)	☑
Responsibilities: Mr. Dragos Zachia is in charge of the project management coordination and implementation.	An organigramme 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, plant manager of PdF II (Mr. Dot) has not been named in the organigramme. See Annex 5 to MP (IRL 8).	☑
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.	☑
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 9)	☑

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

There is no remaining FAR from the First Verification.

2. Data Management System

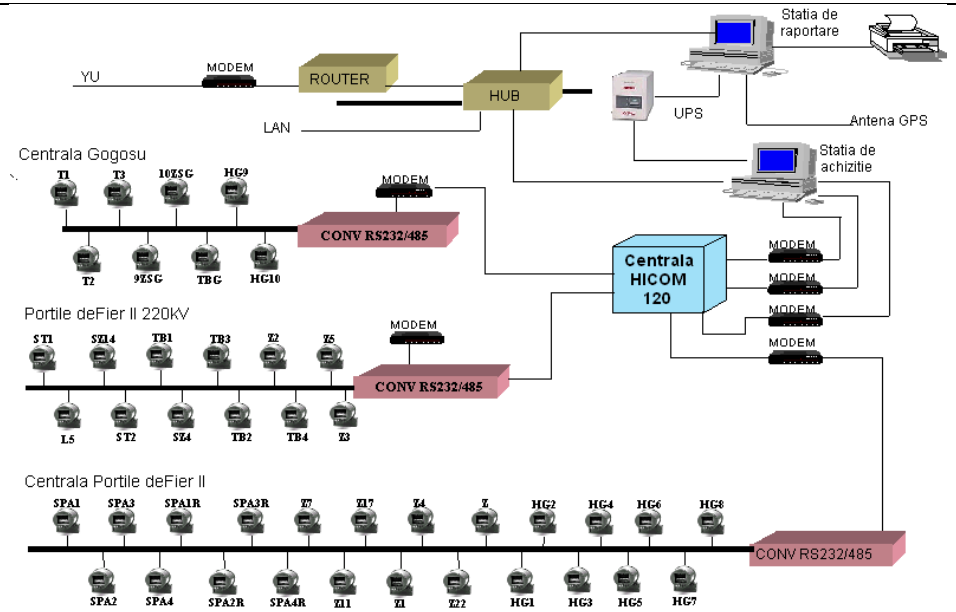
2.1. Description

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 II	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	NA
External data	The generated electricity supplied to the grid - recorded with meters sealed and controlled by CEZ, the regional grid operator.	The regional grid operator CEZ is responsible for calibration and maintenance of meters. Therefore the metered data is regarded as "external".	CEZ is the operator of the Oltenia region and work on the system grids up to 110 kV	☑
External data	Grid Emission Factor - issued by the Romanian authorities and accepted during the assessment of the baseline.	Technical Coordinator, Operation manager	See the web page of the grid operator ANRE www.anre.ro	☑
External data	Turbine Efficiency data vintage - report provided by the company EPFL, Switzerland.	Technical Coordinator, Operation manager	The turbine efficiency data is determined according to a mathematical simulation, which was prepared by the company EPFL, Switzerland. The model covers the efficiency of refurbished and the non-furbished (original status) turbine units	The comprehensive EPFL model results are used for the purpose of energy increase calculations. This is done by implementing a programme (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 on-site PdF II.	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 CD, 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 110 kV HV station (IRL- 13)	☑
Computer b Personal Computer (PC) with integrated server at Hidroelectrica headquarters in Turnu Severin	The measured 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:	na	☑

			
Invoice N/A	na	na	☑
Form e The generated electricity supplied to the grid - recorded with meters sealed and controlled by CEZ, the regional 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 dailypower data used in the calculations.	The delivered/consumed energy is calculated with an algorithm established between the two parties at the power plant and at block level by SC Hidroelecrica SA – SH Porțile de Fier II and SC CEZ SA. 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 14).	
Grid Emission Factor issued by the Romanian authorities and accepted during the assessment of the baseline.	EF is provided by ANRE.	EF is provided by ANRE.	☑
Turbine Efficiency data vintage - report provided by the company EPFL, Switzerland	The data is provided by EPFL report	The data is provided by EPFL report	☑
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 CEZ. *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 II	See remarks in 2.1 and 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	See remarks in 2.1 and 2.2	See remarks in 2.1 and 2.2	☑

and controlled by Transelectrica, the grid operator.			
Grid Emission Factor issued by the Romanian auhorities 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 EPFL, Switzerland.	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.	na	☑
Calculation Tool	The calculation procedure has been described in the Monitoring	The raw data used for calculations are	☑

description	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. Cristian Bocse.	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 data submitted in a CD makes it partly possible to recalculate and check the results. Not all raw data was handed over to the audit team (see CR#8, CR#9 in 2.1).	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 plausible data	The issue of not plausible data has not been mentioned.	The risk of not plausible data is much 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	Data for η (efficiencies) are taken from tables provided by EPFL.	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	$\Delta E = E_A + E_B$ [Mwh] where: 1. E_A – Additional electric energy generated due to the increase of the installed capacity and efficiency The calculation for the entire additional electric energy generated is done with the formula: $E_A = E_a + E_b = \sum_{1}^{8760} ((P-P_{27}) + \Delta\eta * P)$ [Mwh] where: P = hourly measured energy by the counters (hourly medium power) [Mw] P_{27} = maximum power (depending on the head) of old hydrounits [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 hydrounits and the efficiency of the old hydrounits E_B - Additional electric energy for the entire Portile de Fier hydro-electric system	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	☑

	E_B = (dE2+dE1)/2 (dE1 has a negative value) Due to the fact that only for 4 units are within the project boundary only half of the additional electric energy for the entire Portile de Fier hydroelectric system of the Romanian side is considered. The initial electric energy generation (if the heads h2 and hG would not be increased) for Portile de Fier II (respectively Gogosu) are daily calculated $E2_{(h2\text{-}df2)} = \eta_{(h2\text{-}dh2)} \times (h2\text{-}dh2) \times Q_{(h2\text{-}dh2)}$ respectively $EG_{(hG\text{-}dfG)} = \eta_{(hG\text{-}dhG)} \times (hG\text{-}dhG) \times Q_{(hG\text{-}dhG)}$ The gain from Portile de Fier II is: $dE2 = E2+EG-E2_{(h\text{-}dh2)}-EG_{(h\text{-}dh2)}$ where E2 and EG represent the daily electric energy generation. The calculation for the initial electric energy generation (if h1 would not be decreased) is done in a similar way for Portile de Fier I $E1_{(h1\text{-}df1)} = \eta_{(h1\text{-}dh1)} \times (h1\text{-}dh1) \times Q_{(h1\text{-}dh1)}$ The loss for Portile de Fier I is as follows: $dE1 = E1\text{-}E1_{(h1+dh1)}$ where: E1 represents the daily generation.		
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	-	-	Electricity meters	☑
Upstream level	-	-	Level meter Used for calculation of η refurbished.	☑
Down-stream level	-	-	Level meter Used for calculation of η refurbished.	☑
External Data				
P_r	-	-	The hourly electricity is read by electricity meters at 110 kV HV line and is recorded at the SCADA data base	☑
P_{27}	-	-	From baseline data base.	☑
η	-	-	The turbine efficiency of the refurbished and old units are read from the head-power chart using the EPFL model data base.	☑
EF_{grid}	-	-	The EF are gathered from ANRE reports, they are indicated in the determination report as well.	☑
Head	Head	Head	The net head is calculated as the difference between the water level upstream and water level downstream.	☑
Others				
Not appli-				☑

ID-PDD	ID-Meth.	ID-Internal	Description	Conclusion
cable				

3.2. Monitoring Instrumentation

3.2.1. Instrument (QWG002685387 ELSTER)

PDD	Verified Situation	Conclusion
Instrumentation Information		
ID-PDD:	Main meter at the turbine HG4	☑
ID-Internal:	Electricity at the medium voltage (6.3 kV) substation before transformation station (to 110 kV)	☑
Data to be Measured:	Total Electricity at the turbine HG4	☑
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 28.09.2010 onwards in operation	☑
Instrument Type:	Not specified	☑
Serial Number:	**QWG 002 685 387**	☑
Manufacturer Model Nr.:	ELSTER	☑
Specific Location:	The meter is located at the turbine G4 6.3 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:	10.09.2010 (IRL 16)		☑
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, puls	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:	The installed electricity meter operates as 3 phase, quadrant digital meter.	The meter is installed at the turbine unit at 6.3 kV medium high voltage line and was operational.	☑
Quality assurance:	3 phase, quadrant digital meter was installed onsite.	The calibration certificates have been provided (IRL 16).	☑
Maintenance:	The meter is installed at the	No maintenance records were presented so far.	☑

	turbine unit at 15.6 kV medium high voltage line and was operational.		
Further Remarks: No			☑

3.2.2. Instrument (QYG002 698 070, ELSTER)

PDD	Verified Situation	Conclusion
Instrumentation Information		
ID-PDD:	Main meter at the turbine **HG3**	☑
ID-Internal:	Electricity at the medium voltage (6.3 kV) substation before transformation station (to 110 kV)	☑
Data to be Measured:	Total Electricity at the turbine HG3	☑
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 19.12.2006 onwards in operation	☑
Instrument Type:	ELSTER	☑
Serial Number:	**QYG 002 698 070**	☑
Manufacturer Model Nr.:	ELSTER	☑
Specific Location:	The meter is located at the turbine HG3 6.3 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:	23.11.2006 (IRL 16)	☑

Required Calibration Frequency:	8 years		☑
Uncertainty Level:	0.2 %		☑
Monitoring & Calculation			
Reading Frequency:	Online		☑
Recording Frequency:	Hourly		☑
Trouble Shooting:	n/a		☑
Inspection Results During Verification			
Operation of Instrumentation	Method of Verification	Verification Results	Conclusion
Measuring Principle:	3 phase quadrant digital meter, puls	The installed electricity meter operates as 3 phase, quadrant digital meter.	☑
Installation: Manner of execution	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 6.3 kV medium high voltage line.	☑
Quality assurance:	It is referred to the specifications of the supplier.	The calibration certificates were provided (IRL 16).	☑
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 (QWG002 709 048, ABB)

PDD	Verified Situation	Conclusion
Instrumentation Information		
ID-PDD:	Main meter at the turbine **HG 5**	☑
ID-Internal:	Electricity at the medium voltage (6.3 kV) substation before the 110 kV high-voltage TM station	☑
Data to be Measured:	Total electricity generation at turbine HG5	☑
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 10.01.2008 onwards in operation (the unit HG 5 operated since 24.01.2008)	☑
Instrument Type:	ELSTER	☑
Serial Number:	**QWG 002 709 048**	☑
Manufacturer Model Nr.:	ELSTER	☑
Specific Location:	The meter is located at the turbine HG5 6.3 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:	26.09.2007 (IRL 16)	☑

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, puls	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 6.3 kV medium high voltage line.	☑
Quality assurance:	It is referred to the specifications of the supplier.	The calibration certificates were provided (IRL 16)	☑
Maintenance:	It is referred to the specifications of the supplier and the requirements of the grid operator.	N/A	☑
Further Remarks: N/A			☑

3.2.4. Instrument (QWG002 720 905, ABB)

PDD	Verified Situation	Conclusion
Instrumentation Information		
ID-PDD:	Main meter at the turbine **HG 7**	☑
ID-Internal:	Electricity at the medium voltage (6.3 kV) substation before the 110 kV high-voltage TM station	☑
Data to be Measured:	Total electricity generation at turbine HG 7	☑
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 20.01.2009 onwards in operation (the unit HG 7 started to operate on 06.03.2009)	☑
Instrument Type:	ELSTER	☑
Serial Number:	**QWG 002 720 905**	☑
Manufacturer Model Nr.:	ELSTER	☑
Specific Location:	The meter is located at the turbine HG7 6.3 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:	15.01.2009 (IRL 16)	☑

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, puls	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 6.3 kV medium high voltage line.	☑
Quality assurance:	It is referred to the specifications of the supplier.	The calibration certificates were provided (IRL 16)	☑
Maintenance:	It is referred to the specifications of the supplier and the requirements of the grid operator.	N/A	☑
Further Remarks: N/A			☑

3.2.5. Instrument (QWG 002685388, ABB)

PDD	Verified Situation	Conclusion
Instrumentation Information		
ID-PDD:	Main meter at the turbine **HG 6** (not part of the Project, but used as back-up for HG 5 together with the meter of TB III)	☑
ID-Internal:	Electricity at the medium voltage (6.3 kV) substation before the 110 kV high-voltage TM station	☑
Data to be Measured:	Total electricity generation at turbine HG 6	☑
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 13/06/2012 to present The meter, QWG 002685388 has been installed on 13.06.2012 and between 30.05 2011 – 05.07.2012 the unit HG 6 has been out of operation (IRL 36 of the first periodic verification) due to modernisation.	☑
Instrument Type:	ELSTER	☑
Serial Number:	**QYG 5019956**	☑
Manufacturer Model Nr.:	ELSTER	☑
Specific Location:	The meter is located at the turbine HG6 6.3 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:	08.06.2012		☑
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, puls	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 6.3 kV medium high voltage line.	☑
Quality assurance:	It is referred to the specifications of the supplier.	The calibration certificates were provided (IRL 16)	☑
Maintenance:	It is referred to the specifications of the supplier and the requirements of the grid opera-	N/A	☑

	tor.		
Further Remarks: The meter is used as back-up for HG 5 (together with the meter from TB III). See also CL #1			CL 1

3.2.6. Instrument (QWG002698069, ABB)

PDD	Verified Situation	Conclusion
Instrumentation Information		
ID-PDD:	Main meter at the turbine **HG 8** (not part of the Project, but used as back-up for HG 7 together with the meter of TB IV)	☑
ID-Internal:	Electricity at the medium voltage (6.3 kV) substation before the 110 kV high-voltage TM station	☑
Data to be Measured:	Total electricity generation at turbine HG 8	☑
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 16.04.2010 onwards in operation	☑
Instrument Type:	ELSTER	☑
Serial Number:	**QWG002698069**	☑
Manufacturer Model Nr.:	ELSTER	☑
Specific Location:	The meter is located at the turbine HG8 6.3 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:	23.11.2006	☑
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, puls	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 6.3 kV medium high voltage line.	☑
Quality assurance:	It is referred to the specifications of the supplier.	The calibration certificates were provided (IRL 16).	☑

Maintenance:	It is referred to the specifications of the supplier and the requirements of the grid operator.	N/A	☑
Further Remarks: N/A			☑

3.2.7. Instrument (YWG 005 013 693, ABB)

PDD	Verified Situation	Conclusion
Instrumentation Information		
ID-PDD:	Main meter at CEZ substation (110 kV) for **G4 + G3 (TB II)**	☑
ID-Internal:	Total electricity at the HV TM station (to 110 kV) for turbines HG 3 **and** HG 4 (sum)	☑
Data to be Measured:	Total electricity at the turbines HG 3 **and** HG 4 (sum)	☑
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 13.11.2002 until 06/11/2012 when has been replaced with QWG002716747, see bellow.	☑
Instrument Type:	ABB	☑
Serial Number:	YWG 005 013 693	☑

Manufacturer Model Nr.:	ABB	☑
Specific Location:	The meter is located at the neighbouring CEZ high-voltage TM station station in a housing.	☑
Measurement Range:	Voltage : (L) 57/200 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:	07.11.2002 (IRL 16).	☑
Required Calibration Frequency:	10 years **Clarification Request No.1** Some meters – see the meter YWG 005 013 693, - have 10 years required calibration frequency. Others (QWG002698069, for ex.) have 8 years. An explication for different calibration frequencies is requested. The legal requirement for the meter calibration frequency is also requested.	CL #1
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, puls	The installed electricity meter operates as 3 phase, quadrant digital meter.	☑
Installation:	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 in the substation at 110 kV high voltage line.	☑
Quality assurance:	It is referred to the specifications of the supplier.	The calibration certificates were provided (IRL 16).	☑
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 (QWG002716747, ABB)

PDD	Verified Situation	Conclusion
Instrumentation Information		
ID-PDD:	Main meter at CEZ substation (110 kV) for **G4 + G3 (TB II)**	☑
ID-Internal:	Total electricity at the HV TM station (to 110 kV) for turbines HG 3 **and** HG 4 (sum)	☑
Data to be Measured:	Total electricity at the turbines HG 3 **and** HG 4 (sum)	☑
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 06/11/2012 to present	☑
Instrument Type:	ABB	☑
Serial Number:	QWG 002716747	☑
Manufacturer Model Nr.:	ABB	☑
Specific Location:	The meter is located at the neighbouring CEZ high-voltage TM station station in a housing.	☑
Measurement Range:	Voltage : (L) 57/200 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:	15.07.2008 (IRL 16)	☑

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, puls	The installed electricity meter operates as 3 phase, quadrant digital meter.	☑
Installation:	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 in the substation at 110 kV high voltage line.	☑
Quality assurance:	It is referred to the specifications of the supplier.	The calibration certificates were provided (IRL 16).	☑
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			☑

3.2.9. Instrument (YWG005 013 695, ABB)

PDD	Verified Situation	Conclusion
Instrumentation Information		
ID-PDD:	Main meter at CEZ HV TM station (110 kV) for **G5 + G6 (TB III)**	
ID-Internal:	Total electricity at the HV TM station (to 110 kV) for turbines HG 5 **and** HG 6 (sum)	☑
Data to be Measured:	Total electricity at the turbines HG 5 **and** HG 6 (sum)	☑
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:	07.03.2003 up to the present	☑
Instrument Type:	ABB, not specified	☑
Serial Number:	**YWG 005 013 695**	☑
Manufacturer Model Nr.:	ABB	☑
Specific Location:	The meter is located at the neighbouring 110 kV CEZ TM station in a housing	☑
Measurement Range:	Voltage : (L) 57/200 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:	14.02.2003		☑
Required Calibration Frequency:	10 years		☑
Uncertainty Level:	0.2 %		☑
Monitoring & Calculation			
Reading Frequency:	Online		☑
Recording Frequency:	Hourly		☑
Trouble Shooting:	n/a		☑
Inspection Results During Verification			
Operation of Instrumentation	Method of Verification	Verification Results	Conclusion
Measuring Principle:	3 phase quadrant digital meter, puls	The installed electricity meter operates as 3 phase, quadrant digital meter.	☑
Installation:	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 in the substation at 110 kV high voltage line.	☑
Quality assurance:	It is referred to the specifications of the supplier.	The calibration certificates were provided (IRL 16).	☑
Maintenance:	It is referred to the specifications of the supplier and the requirements of the grid operator.	No maintenance records were reported so far.	☑
Further Remarks: N/A			☑

3.2.10. Instrument (YWG005013692, ELSTER)

PDD	Verified Situation	Conclusion
Instrumentation Information		
ID-PDD:	Main meter at CEZ HV TM station (110 kV) for **G7 + G8 (TB IV)**	☑
ID-Internal:	Total electricity at the HV TM station (to 110 kV) for turbines HG 7 **and** HG 8 (sum)	☑
Data to be Measured:	Total electricity at the turbines HG 7 **and** HG 8 (sum)	☑
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 10.04.2009 up to the present	☑
Instrument Type:	ELSTER, not specified	☑
Serial Number:	**YWG005013692**	☑
Manufacturer Model Nr.:	ELSTER	☑
Specific Location:	Description The meter is located at the turbines HG7 and HG8, 400V 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:	23.11.2006		☑
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, puls	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 0.4 kV low-voltage line.	☑
Quality assurance:	It is referred to the specifications of the supplier.	The calibration certificates were provided (IRL 16).	☑
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			☑

3.2.11 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 18).	☑
Required Calibration Frequency:	Every 6 month	☑

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 Instrumen-tation	Method of Verification	Verification Results	Conclusion
Measuring Principle:	In compliance with meth./PDD	See	☑
Installation:	Not specified		☑
Functionality:	It is referred to the bi-annual reports and annual check of the devices.	The position could be verified onsite	☑
Quality assurance:	It is referred to the bi-annual reports and annual check of the devices.	The functionality could be verified onsite	☑
Maintenance:	It is referred to the bi-annual reports and annual check of the devices.		☑
Further Remarks: N/A			☑

3.3. Sampling Information (not relevant)

3.4. Accounting information (not applicable)

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

3.5. External Data

PDD	Verified Situation	Conclusion
External Data		
ID-PDD:	Level, head	☑
ID-Internal:		☑
Description of Data / Data Refers to:	The upstream and downstream levels of the Danube river at the PdF II are measured for the calculation of net head.	☑
Unit of Data (if appropriate):	m	☑
Date of Data Income:	continuous	☑
Source of Data:	TLN measurements	☑
Reliability of Data Source:	Calibration (IRL 18)	☑
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:	Turbine efficiency	☑
Description of Data / Data Refers to:		☑

Unit of Data (if appropriate):	%	☑
Date of Data Income:	EPFL report	☑
Source of Data:	EPFL report	☑
Reliability of Data Source:		☑
Is the Data up-to-date?		☑
Uncertainty Level:	n.a.	☑
Further Remarks: N/A		☑

PDD	Verified Situation	Conclusion
External Data		
ID-PDD:	P	☑
ID-Internal:	Generated Electricity	☑
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, at the substation and the 110 kV CEZ HV TM station	☑
Reliability of Data Source:		☑
Is the Data up-to-date?		☑

Uncertainty Level:	0.2%	☑
Further Remarks: N/A		☑

3.6. Others (not applicable)

Industrie Service

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 21).	☑
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:			☑

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 17) there were only minor events with no real impact on the project. The total availability of the turbines was more than 90% of time.	☑
Documentation	Turbine logs		☑
Measures			☑
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. **Corrective Action Request No.1** In the MR, page 11, it's mentioned that the lower than estimated in PDD, ERUs for the year 2012, are due to the hydrology in the year 2012. This statement shall be elaborated in more details and normal/year 2012 flows for Danube river shall be included also.	CAR #1
Further Remarks:			☑

4.6 Completeness and Correctness

Description of completeness and correctness			
	Description	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 13, 14, 15) and by random daily checks All data checked were found to be cor-rected collected, calculated and stored and further interpreted as for CO2 emission reduction purposes.	☑
Completeness	The data provided for the assessment is complete		☑
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 01/01/2012 until 28/11/2012.	☑
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	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.	☑
Further Remarks: N/A **Corrective Action Request No.2** The MR shall include on the first page the exact time duration of this second monitoring period: 01/01/2012 to 28/11/2012>		CAR #2

The emission reductions, for each year are presented below:

Year	**2012**
CEF (tCO_2/GWh)	763
ERU (tCO_2) realised	**32,907**

7 Compilation and Resolution of CARs, CRs and FARs for PdF 2

Corrective Action Request by audit team	**Summary of project owner response**	**Audit team conclusion**
Corrective Action Request No.1 In the MR, page 11, it's mentioned that the lower than estimated in PDD, ERUs for the year 2012, are due to the hydrology in the year 2012. This statement shall be elaborated in more details and normal/year 2012 flows for Danube river shall be explained also.	The differences occur due to the hydrology on the Danube in this specific year, which was a very dry year, like illustrated in the table below for each month of 2012:	The explanation provided is clear. This issue is closed.

Month	Multiannual average flow	Flow in 2012	2012/average
1	4687	3798	0.81032643
2	4971	3155	0.63468115
3	6455	5567	0.86243222
4	7751	6069	0.78299574
5	7492	6047	0.8071276
6	6473	5753	0.88876873
7	5423	3836	0.70735755
8	4396	2863	0.65127389
9	3892	3073	0.78956835
10	3926	3199	0.81482425
11	4685	4708	1.00490928
average	5468	4370	0.79584229

Corrective Action Request No.2 The MR shall include on the first page the exact time duration of this second monitoring period: 01/01/2012 to 28/11/2012.	The MR has been corrected to the version 2, dated 05/12/2012.	The audit team checked the new version of the MR (IRL 6) and confirms that the title is in line with the monitoring period. This issue is closed.
Clarification Requests by the audit team	**Summary of project owners response**	**Audit team conclusion**
Clarification Request No.1 1. Some meters – see the meter YWG 005 013 693, - have 10 years required calibration frequency. Others (QWG002698069, for ex.) have 8 years. An explication for different calibration frequencies is requested. The legal requirement for the meter calibration frequency is also requested 2. Evidence that Senter Novem, the initial buyer of the ERUs, is now part of the NL Agency is requested.	1. All meters are calibrated by authorized firms according to the Romanian legislation in force at the time of verification. Since 2001 till 2012 the legislation regarding the metrology verification was changed as follows: 2001 - Order no. 144 of RBLM established in annex 1 position L81 a periodicity of verification for energy meter of 10 years; 2004 – Order no.27 of the Romanian Bureau of Legal Metrology (RBLM) established in annex 1 position L81 a periodicity of verification for energy meter of 5 years 2. Message from Mrs. Boschma, Sietske: “NL Agency came about in early 2010 through a merger of EVD, Netherlands Patent Office (Octrooicentrum Nederland) and SenterNovem. This merger will soon allow us to be of even better service to you as a result of a collective focus: one customer support desk, coherent programmes, better coordinated financing programmes and transparent, short procedures”.	The explanations are considered satisfactory by the verification team. This issue is closed.
Forward Action Request by audit team	**Summary of project owner response**	**Audit team conclusion**

Annex 2: Information Reference List

Information Reference List	2012-12-20	Periodic Verification of the JI track 1 Project: “Modernization of 4 hydro units in Portile de Fier II Power 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	2003	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 “Modernization of 4 hydrounits in Portile de Fier II hydro station”	Hidroelectrica	
5	14/11/2008	Determination Report of JI project “Modernization of 4 hydrounits in Portile de Fier II hydro station”, Report No.1068445b, Revision 2	TÜV SÜD	
6	05/12/2012	Monitoring Report of JI project “Modernization of 4 hydrounits in Portile de Fier II hydrostation” for the monitoring period 01/01/2012 to 28/11/2012, ver. 1 dated 29/11/2012 Monitoring Report of JI project “Modernization of 4 hydrounits in Portile de Fier II hydrostation” for the monitoring period 01/01/2012 to 28/11/2012, ver. 2 dated 05/12/2012	Hidroelectrica	
7	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	
8	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	
9	05/12/2012	Certificates on implemented QM systems ISO 9001, ISO 14001 and ISO 18001, validity: 22/06/2015	Hidroelectrica	

10	19/08/2008	Maintenance Contract with Hidroserv	Hidroelectrica	
11	March 2008	Annex 6 to MP Portile de Fier I : Statistical adjustment procedure of the output data to operational conditions	Hidroelectrica	
12	March 2008	Annex 7 to MP Portile de Fier I : Description of the monitoring parameters of the project activity	Hidroelectrica	
13	05/12/2012	**Annex 1_2_Energy_Protocols_OMEPA_P2 (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 110 kV - Purchased electricity from the grid for each individual turbine unit at 110 kV In “PV_PF2_2012.pdf”	Hidroelectrica, Transelectrica	PdF I and PdF II
14	05/12/2012	**Cross_check_meters_(OMEPA_internal_meters)** SCADA data output on electricity data records at the internal (ABB/PdF II) and external (OMEPA/CEZ) meters for cross check “Diferente statia 110 KV (TB) si centrala PFII (HG) iulie 2012.pdf»	Hidroelectrica, Transelectrica	PdF I and PdF II
15	05/12/2012	**Cross_check_energy_Romania_Serbia** Bi-annual report on generated electricity data cross check for the Serbian-Romanian commission (2012) Folders “Sesiunea 085_2012” and Sesiunea 086_2012”	Hidroelectrica	
16	05/12/2012	**Annex 1_1_Calibration_(and meter scheme)_P2** Single line diagramme with the positioning of the meters, “evidenta contori PFI si PFII 2012 la 01.12.2012.docx” and calibration certificates for «BVM TB2 montat la 06.11.2012.pdf» HG6 NOU PFII.pdf Annex_1_1_Calibration_(and meter scheme)_P2 (IRL 21 of the First Periodic Verification).	Hidroelectrica	New meter calibration certificate installed at TB2 and HG 6
17	05/12/2012	Turbine History data on operation, breakdown and maintenance period for 01/01/2012 to 28/11/2012 “Anexa10_2012.xls”	Hidroelectrica	

18	05/12/2012	Technical summary on the functionality of the water level-meters (“telelimnimetru”) Folder: “Sesiunea LXXXV2012”	Hidroelectrica	Level meters calibration for the period 2012
19	2012	http://www.anre.ro/documente.php?id=395	ANRE	
20	28-02-2012	Working Procedures Romania/Serbia (SCDE). Attachement to Annex 5 of MP	Hidroelectrica	JI Procedures
21	28-02-2012	PO-HE-PF-138 Catalogare codificare achizitie echipam tehn calcul ed5 rev0	Hidroelectrica	
22	28-02-2012	PO-HE-PF-190 Gestionare materiale utilaje trimise rep la terti ed2 rev0	Hidroelectrica	
23	05/12/2012	Print screens for 04/12/2012: «PdF_print_screen_04_12.pdf»	Hidroelectrica	
24	05/12/2012	2012PF2.XLS	Hidroelectrica	Calculation files for ERUs
25	11/2006	Topogeodetic works for Level Reference, 11/2006 by Hidroelectrica (IRL 16 of the Determination Report)	Hidroelectrica	Level meters accuracy
26	05/12/2012	E22012.DOC	Hidroelectrica	Results of excel calculation files

39	04/12/2012	On-site interviews on 04/12/2012 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 Mr Ciprian Rachitan Metering responsible , SH Portile de Fier Mr Staiculescu Petre STIC, SH Portile de Fier 2 **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	