



South Asia

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Verification Report

Periodic Verification of the Registered CDM Project
“Construction of additional cooling tower cells at AES Lal
Pir (Pvt) Limited. Muzaffar Garh, Pakistan”

UNFCCC 2401-CDMP

Monitoring period 1: 01-05-2009 to 30-04-2011

Report No. 600500925

15 March 2013

TÜV SÜD South Asia Pvt. Ltd.
Environmental Technology
Carbon Management Service
Solitaire, I.T.I. Road, Aundh
Pune- 411007
INDIA

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| Report No. | Date of first issue | Version No.: | Revision date |
|--|-----------------------------|--|---------------|
| 600500925 | 06-07-2012 | 06 | 15-03-2013 |
| Subject: | First Periodic Verification | | |
| Executing Operational Unit: | | | |
| TÜV SÜD South Asia Pvt. Ltd. Environmental Technology, Carbon Management Service, Solitaire, I.T.I. Road, Aundh Pune- 411007, INDIA | | | |
| Project Participant (client): | | | |
| AES Lal Pir (Pvt.) Limited, Pakistan The initially stated project participant AES Carbon Exchange Ltd has withdrawn. | | | |
| Registration number / Project Title | | Project 2401: "Construction of additional cooling tower cells at AES Lal Pir (Pvt) Limited. Muzaffar Garh, Pakistan" | |
| Monitoring period: | | 01-05-2009 to 30-04-2011 | |
| First Monitoring Report (version/date) | | Version 01 / 07-12-2011 | |
| Final Monitoring Report (version/date) | | Version 06 / 15-03-2013 | |
| Summary: | | | |
| <p>TÜV SÜD South Asia Pvt. Ltd has performed the first periodic verification of the registered CDM project: "Construction of additional cooling tower cells at AES Lal Pir (Pvt) Limited. Muzaffar Garh, Pakistan". The project consists of the erection of an 8th cooling water cell next to the initial seven at each site. The power plant consists of two sites, the Lal Pir site and the Pak Gen site. Each site corresponds to one unit of 365 MW. The steam which is generated after the combustion of heavy fuel oil (HFO) is converted to water by bringing it into contact with water which comes from the cooling towers.</p> <p>The management of AES Lal Pir (Pvt.) Limited, Pakistan is responsible for the preparation of the GHG emissions data and the reported GHG emission reductions.</p> <p>A document review, followed by a site visit was conducted to verify the information submitted by the project participant regarding the present verification period. Based on the assessment carried out, the verifier confirms the following:</p> <ul style="list-style-type: none">the project has been implemented and operated in accordance with the description given in the registered PDD (version 7, 19-12-2008, registration date 01-05-2009).the project is completely implemented as described in the registered PDD.the monitoring plan complies with the applied methodology (AMS II.B, version 9) and the monitoring has been carried out in accordance with the monitoring plan. <p>Installed equipment essential for generating emission reductions run reliably and the meters are calibrated appropriately. The project is generating emission reductions as a CDM project.</p> <p>The verifier can confirm that the GHG emission reductions are calculated without material misstatements. Our opinion refers to the project's GHG emissions and resulting GHG emission reductions reported, both determined using the valid and registered project's baseline, its monitoring plan and its associated documents.</p> <p>Based on the information we have seen and evaluated, we confirm that the implementation of the project resulted in 41,080 t CO_{2e} of emission reductions during the verification period from 01-05-2009 to 30-04-2011.</p> | | | |

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| | |
|--|--|
| Assessment Team Leader: Khalid Mahmood Verification Team Members: Georgios Agrafiotis Mahmood Syed | Technical Reviewers: Karin Wagner Luciano Grugni, Thomas Kleiser |
|--|--|

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Abbreviations

| | |
|------------------------|---|
| ACM | Approved Consolidated Methodology |
| BM | Build Margin |
| CAR | Corrective Action Request |
| CDM | Clean Development Mechanism |
| CDM-EB | CDM Executive Board |
| CER | Certified Emission Reduction |
| CM | Combined Margin |
| CMP | Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol |
| CO_{2e} | Carbon dioxide equivalent |
| CR / CL | Clarification Request |
| DNA | Designated National Authority |
| DOE | Designated Operational Entity |
| EF | Emission Factor |
| EIA / EA | Environmental Impact Assessment / Environmental Assessment |
| ER | Emission Reduction |
| 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 |
| KP | Kyoto Protocol |
| LP | Lal Pir |
| MP | Monitoring Plan |
| MR | Monitoring Report |
| NGO | Non-Governmental Organisation |
| OM | Operational Margin |
| PG | Pak Gen |
| PDD | Project Design Document |
| PP | Project Participant |
| TÜV SÜD | TÜV SÜD South Asia Pvt Ltd |
| UNFCCC | United Nations Framework Convention on Climate Change |
| VVM | Validation and Verification Manual version 1.2 |
| WAPDA | Water and Power Distribution Authority of Pakistan |

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Main Documents (referred to in this report)

| | | |
|------------------------------|---|------------|
| Methodology (name / version) | AMS II.B, Version 9 | |
| Scope | 1 | |
| Technical Area | 1.1 | |
| Registered PDD: | Version 7, date 19-12-2008 | |
| Revised Monitoring Plan: | N/A | |
| | Version | Date |
| Published Monitoring Report | 01 | 07-12-2011 |
| Revised Monitoring Report | 05 | 15-11-2012 |
| Project documentation link: | http://cdm.unfccc.int/Projects/DB/SGS-UKL1234427590.22/view | |

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Annex 1: Verification Protocol

Annex 2: Information Reference List

Annex 3: Appointment Certificates

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1 INTRODUCTION

1.1 Objective

AES Lal Pir (Pvt.) Limited, Pakistan has commissioned an independent verification by TÜV SÜD South Asia Pvt Ltd (TÜV SÜD) of its registered CDM project: “Construction of additional cooling tower cells at AES Lal Pir (Pvt) Limited. Muzaffar Garh, Pakistan”.

The objective of the verification work is to comply with the requirements of paragraph 62 of the CDM Modalities and Procedures. According to this assessment TÜV SÜD shall:

- ensure that the project activity has been implemented and operated as per the registered PDD “Construction of additional cooling tower cells at AES Lal Pir (Pvt) Limited. Muzaffar Garh, Pakistan” Version 07, 19-12-2008, 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, verifiable and in accordance with applicable CDM requirements,
- ensure that the actual monitoring systems and procedures comply with the monitoring systems and procedures described in the monitoring plan and the approved methodology
- evaluate the data recorded and stored as per the “Supply side energy efficiency improvements-generation”, AMS II.B Version 09.

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 Designated Operational Entity. The verification is based on the submitted monitoring report, the validated project design documents including its monitoring plan and validation report, the applied monitoring methodology, relevant decisions, clarifications and guidance from the CMP and the EB and any other information and references relevant to the project activity's resulting emission reductions. These documents are reviewed against the requirements of the Kyoto Protocol, the CDM Modalities and Procedures and related rules and guidance.

Based on the requirements in the VVM, 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.

1.3 GHG Project Description

| | |
|-----------------------------|--|
| Project activity: | “Construction of additional cooling tower cells at AES Lal Pir (Pvt) Limited. Muzaffar Garh, Pakistan” |
| UNFCCC registration number: | 2401 |
| Project Participant: | AES Lal Pir (Pvt.) Limited, Pakistan |
| Location of the project: | Longitude 70.99 E |

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Latitude 30.17 N

Date of registration: 01-05-2009
Starting date of the renewable
crediting period: 01-05-2009

An 8th cooling water cell has been installed next to the initial seven at each site. The power plant consists of two sites, the Lal Pir site (LP) and the Pak Gen site (PG). Each site corresponds to one unit of 365 MW.

In all cells steam which is generated after the combustion of heavy fuel oil (HFO) in order to produce electricity is converted to liquid water (it is being condensed) by bringing it into contact with cold water which is sprayed from the cooling towers. Then the water circulates back to the boiler to become again steam through combustion of HFO. By improving the condensing process of the steam less low pressure occurs which increases the efficiency of the turbine.

On the other hand, the cooling water increases its temperature after condensing the steam but returns to the pipes and there lowers again its temperature to be used again for condensing purposes, as described above.

The more efficient the condensing process and respectively the turbine performance it is, the lower the consumption of HFO and respectively the CO₂ emissions from combustion. So the erection of the 8th cooling tower increased the efficiency of the process and led to reduction of THG to the atmosphere.

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2 METHODOLOGY

2.1 Verification Process

The verification process is based on the approach depicted in the Validation and Verification Manual.

Standard auditing techniques have been adopted for the verification process. The verification team performs first a desk review, followed by an on-site visit, which results in the formation of a protocol that includes all the findings. The next step involves the evaluation of the findings through direct communication with the PPs and then finally the preparation of the verification report. This verification report and other supporting documents then undergo an internal quality control by the CB “Environment and Energy” before submission to the CDM-EB.

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 CB TÜV SÜD operates the following qualification levels for team members that are assigned by formal appointment rules:

- Assessment Team Leader (ATL);
- Verifier (V);
- Verifier Trainee (T);
- Technical Experts (TE).

The verification team consisted of the following members:

| Name | Qualification | Coverage of scope | Coverage of technical area | Coverage of financial aspect | Host country experience |
|-------------------------------|---------------|-------------------------------------|-------------------------------------|------------------------------|-------------------------------------|
| Khalid Mahmood | ATL | <input checked="" type="checkbox"/> | | N/A | <input checked="" type="checkbox"/> |
| Georgios Agrafiotis (on-site) | V | <input checked="" type="checkbox"/> | | N/A | |
| Mahmood Syed (on-site) | TE | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | N/A | <input checked="" type="checkbox"/> |

Technical reviewers:

- Karin Wagner, Luciano Grugni, Thomas Kleiser

2.3 Review of Documents

The Monitoring Report version 01 submitted by the PP was made publicly available on the UNFCCC website before the verification activities started. The published MR was assessed based on all the relevant documents as listed above. The aim of the assessment in the desk review was to:

- verify the completeness of the data and the information presented in the MR,

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- check the compliance of the MR with respect to the monitoring plan depicted in the registered PDD and verify that the applied methodology was carried out. 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 25-04-2012 to 26-04-2012, TÜV SÜD performed a physical site inspection and on-site interviews with project stakeholders to:

- confirm the implementation and operation of the project,
- review the data flow for generating, aggregating and reporting the monitoring parameters,
- confirm the correct implementation of procedures for operations and data collection,
- cross-check the information provided in the MR documentation with other sources,
- check the monitoring equipment against the requirements of the PDD and the approved methodology, including calibrations, maintenance, etc.,
- review the calculations and assumptions used to obtain the GHG data and ER,
- identify if the quality control and quality assurance procedures are in place to prevent or correct errors or omissions in the reported parameters.

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 evidence items submitted, the following relevant and reliable evidence material have been used by the audit team during the verification process:

- Electricity production data 2009-2011 (IRL 17, IRL 18)
- Fuel consumption data 2009-2011 (IRL 16)
- Calibration Certificates of electricity meters and flow meters (IRL 12, IRL 13, IRL 24, IRL 25)
- Quality Control Document (Environmental, Health and Safety policy, IRL 9)

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

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2.6 Resolution of Clarification and Corrective 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 positive conclusion of the achieved GHG emission reduction. The findings raised as Forward Action Requests (FARs) (if any) indicated in previous reports (validation/verification) were discussed during this phase and, issues raised in the FARs were resolved, during communications between the PP and TÜV SÜD.

Concerns raised in the desk review, the on-site audit assessments and the follow up interviews and the responses provided for the raised concerns are documented in Annex 1 (verification protocol) to guarantee the transparency of the verification process.

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;
- FARs stated during validation 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 clear 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, CL or FAR could also lead to a new request.

2.7 Internal Quality Control

As a final step of verification, the final documentation including the final verification report, certification report and all necessary documents have to undergo an internal quality control by the Certification Body (CB) "Environment and Energy", i.e. each report has to be finally approved by the CB Committee. In projects where one of the CB Committee members is part of the assessment team, the approval is given by the rest of the committee. If the documents have been satisfactorily approved, the Request for Issuance is submitted to the CDM-EB 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 final PDD and Monitoring Report (15-03-2013, version 6). The verification findings for each verification subject are presented below.

3.1 FARs from Validation / Previous Verification

No FARs have been presented in the validation report.

3.2 Project Implementation in accordance with the registered Project Design Document

The project is fully implemented according to the description presented in the registered PDD. The verifier confirms, through the visual inspection that all physical features of the proposed CDM project activity including data collecting systems and storage have been implemented in accordance with the registered PDD. The project activity is completely operational and the same has been confirmed on-site.

In comparison to the registered PDD the achieved ERs during the 1st MP are higher. The heat rate improvement was higher than estimated in the PDD where it was rather underestimated. The study from the Italian designer SPIG S.p.A. (IRL 31) states that erection of an 8th cooling tower would result in a reduction of the cooling water temperature of approximately 2°C. Based on that the project participant estimated an increase in the heat rate of approximately 40 Btu/kWh.

Still, a recent Process Hazard Analysis (IRL 32) of the company Avanceon states that per 1°C reduction of the cooling water temperature an improvement of approximately 24,000-27,000 PKR/hr can be reached. This value corresponds to 39,29 Btu/kWh based on the fuel price of 1,963 PKR/MioBtu and the average hourly value of electricity export 350.000 kWh. The calculation can be traced in the respective excel file (IRL 33). The proof of the average available capacity of 350 MW has been also delivered to TÜV SÜD (IRL 34). According to this fact a reduction of 2°C of the cooling water temperature would lead to an improvement of the heat rate of approximately 80 Btu/kWh. The fact that only a cooling tower was added and no revamping took place, is evidenced by the result of the project activity: the increase of heat rate to 78 Btu/kWh during the first 12 months and to 65 Btu/kWh during the next 12 months would have been much more if also revamping had been carried out (see Spig study, IRL 31). No revamping took place in the power plant and same has been discussed and confirmed during onsite visit by the audit team. A confirmation letter from Lal Pir Power Limited that has been provided to DOE stating that no revamping took place in power plant also confirms the same (IRL 38). In addition, the higher value of ERs does not influence the additionality of the project, since it has been proven as per the "Barrier due to prevailing practice". The lack of technical knowledge from other similar projects in Pakistan as well as of skilled labor was an insurmountable barrier which was removed by the extra income from the CERs. No investment analysis was conducted. The applicability criteria of the applied methodology are not influenced. Also the scale of the CDM projects remains small since Type II requires that the improvement in the electricity production cannot exceed 60 GWh_e/yr while the project reached during the first full year of operation to an improvement of 0.93 GWh_e/yr. During the second year it had even a

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lower production than in the baseline year 2007 due to the flood which caused a major stop of operation.

During the first 12 months of the 1st MP the electricity production was equal to 15,559.2 TJ while during the baseline year 2007, it was equal to 12,211.2 TJ. TÜV SÜD cross-checked if the baseline situation would have been able to produce the same electricity as during the MP. The 8th cooling tower was commissioned in December 2008, having thus a very limited influence on the production capacity of the power plant. Production data from 2008 (IRL 35) which was based to a large extent only on seven cooling towers show electricity production which corresponds to 14,074 TJ. This value has been cross-checked against the respective invoices (IRL 36). By the implementation of the project activity, there was no change in the generation capacity of the power plant, only improvement was in the heat rate by reducing the fuel consumption. Total monthly export in March 2008 (with 7 cooling tower cells) was 465,442 MW while the maximum monthly export during the monitoring period was 465,754 MW in May 2009 which clearly shows that the project activity did not increase the capacity of the power plant. This fact indicates that production levels of this range were reachable also with the seven cooling towers. Until now the demand from Pakistani grid was did not require higher production. It can be confirmed that technically it would have been possible to produce the same amount of electricity as during the MP also with seven cooling towers just by increasing the fossil fuel consumption.

3.3 Compliance of the Monitoring Plan with the Monitoring Methodology

The monitoring plan is in accordance with the approved methodology, AMS II.B, Version 9, applied by the proposed CDM project activity. Neither a revision nor a deviation to the monitoring plan has been requested to the CDM Executive Board.

3.4 Compliance of the Monitoring with the Monitoring Plan

The monitoring has been carried out in accordance with the monitoring plan contained in the registered PDD. All parameters were monitored and determined as per the Monitoring Plan.

The verification of the parameters required by the monitoring plan is provided as follows:

| | |
|-----------------------------|---|
| Data / Parameter: | FC _{fuel oil, y} |
| Data unit: | TJ |
| Description: | Yearly consumption of fossil fuel in year “y” by the facility |
| Source of data used: | <p>The flow meter delivers automatically values in units [t/min]. TÜV SÜD has checked the technical specifications (IRL 10) and the calibration certificates (IRL 12) where the final units are stated. In the calculation tool by the use of the default NCV the mass units are transformed to energy units [J].</p> <p>The audit team asked and received the electronically transmitted and archived hourly raw data of fuel flow for the whole MP. The result between the raw data and the data that are used in the calculation tool are 100% consistent.</p> <p>According to the manufacturer of the flow meter no calibration is required (IRL 10).</p> <p>For reasons of quality assurance the equipment has been calibrated by the company Micro Motion Inc. in regular intervals showing no deviation:</p> <p>Flow meter at Lal Pir (IRL 12): 10.11.2008, 08.11.2009, 14.10.2010, 04.12.2010, 16.12.2011</p> |

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| | |
|---------------------------------|---|
| | Flow meter at Pak Gen (IRL 12): 10.11.2008, 03.09.2009, 09.09.2010, 09.10.2011 The laboratory / third party used are accredited for the activity, hence the information can be considered verifiable. |
| Means of verification/Comments: | During the on-site audit the audit team conducted a real time check of the current measured value. The displayed value was approximately the same with the value that was automatically saved in the server. The audit team checked in the offices the value at the server a few minutes after having noted down the value of the flow meter. Due to the fact that the values of fuel consumption are recorded hourly, the value of 81 t/h noted at 16:27 deviated slightly from the one seen a bit later at the monitor. |
| Cross-check | N/A |

| | |
|---------------------------------|--|
| Data / Parameter: | EGy |
| Data unit: | MWh |
| Description: | Net Electricity Generated exported by plant |
| Source of data used: | <p>This data is continuously electronically transmitted to and saved in the server. Grid operator has also the same data. Continuously net production data are transmitted to the plant owner for their own cross check.</p> <p>The equipment used has been calibrated according to the requirements of the approved monitoring plan.</p> <p>Calibrations over the monitoring period:</p> <p>Before flood:</p> <p>Main meters 11.02.2009 (LP&PG)</p> <p>Back-up meters 22.01.2007 (LP) 09.10.2006 (PG)</p> <p>After flood:</p> <p>13.11.2010 (All four LP meters) 08.10.2010 (PG main meter 1) 09.10.2010 (PG main meter 2 & back-meters)</p> <p>The third party used is the grid operator WAPDA and is accredited for the activity, hence the information can be considered verifiable.</p> |
| Means of verification/Comments: | Data is continuously measured and recorded every 30 min digitally at the meter itself. Monthly these data are retrieved electronically in presence of customer which is the grid. On-site it was possible on both days to see how the grid operator conducts the controls of the data. Meter values every 30 min are being retrieved from the meter through the cable and in parallel through internal communication the project owner certifies that the same value is being displayed at their devices in the offices. Additionally, TÜV SÜD asked and received the raw data of net electricity production for the whole MP. |
| Cross-check | Moreover TÜV SÜD cross-checked the monthly values of electricity generation against the invoices (IRL 26) that were issued by the grid operator who purchases the electricity. |

| | |
|--------------------------|--|
| Data / Parameter: | NCV fuel oil |
| Data unit: | GJ/t |
| Description: | Net calorific value of Fuel |
| Source of data used: | These monitored and recorded data are not used for the calculation of the ERs. The reason is that applied methodology AMS II.B, version 9, §7 states |

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| | <p>that a default parameter is needed. These are only monitored in order to fully comply with the registered MP and for quality assurance as part of the internal procedure. The results were in a reasonable range.</p> <p>Data is archived electronically on the server of the company. Data is transmitted to the server file manually.</p> <p>The equipment used has been calibrated according to the requirements of the approved monitoring plan.</p> <p>Latest calibrations (IRL 19):</p> <p>02.10.2008 01.10.2009 15.11.2010 14.10.2011 02.01.2012</p> <p>The laboratory / third party used are accredited for the activity, hence the information can be considered verifiable.</p> |
| Means of verification/Comments: | <p>These monitored and recorded data are not used for the calculation of the ERs. These are only monitored for quality assurance as part of the internal procedure.</p> <p>Several random daily reports have been delivered. These values were cross-checked against the electronically transmitted values which can be seen in the daily records and have been found consistent</p> |
| Cross-check | N/A |

| | |
|---------------------------------|---|
| Data / Parameter: | $\rho_{\text{fuel,oil}}$ |
| Data unit: | t/m ³ |
| Description: | Density of fuel oil |
| Source of data used: | <p>These monitored and recorded data are not used for the calculation of the ERs. These are only monitored for quality assurance as part of the internal procedure. The values were normal.</p> <p>Data is saved in the server. Data is transmitted to the server file manually by the plant chemist.</p> <p>No calibration is required for this simple Hydrometer (density meter).</p> |
| Means of verification/Comments: | <p>Several random daily reports have been delivered. These values were cross-checked against the electronically transmitted values which can be seen in the daily records.</p> |
| Cross-check | N/A |

3.5 Assessment of Data and Calculation of Greenhouse Gas Emission Reductions

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

The reported data have been cross-checked against other sources available as explained above in chapter 3.4.

The verifier confirms that the methods and formulae used to obtain the baseline, project and leakage emissions are appropriate. The same has been done in accordance with the methods and formulae described in the registered monitoring plan and applicable methodology.

The verifier confirms that the monitoring report includes all parameters and the monitored data at the intervals required by the methodology and PDD.

The verifier confirms that all the emission factors and default values (ex-ante values from PDD) have been correctly justified. All the emission factors and default values are explicitly mentioned in the monitoring report.

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In the MR the use of the terms "baseline emissions" and "project emissions" deviates slightly from the established definitions. Baseline emissions are defined as the CO₂ emissions that occurred from the electricity production from the two sites during the fixed baseline year 2007 (seven cooling towers at each site) and project emissions are defined as the CO₂ emissions that occurred after the implementation of the CDM project (eight cooling towers at each site). The difference between the two values are the achieved emission reductions of CO₂e due to the CDM project.

This approach complies fully with the registered PDD, version 7, chapter B.6.3 and the rationale of the applied methodology AMS II.B, version 09.

In the course of the information and reporting check, the following remark was raised by UNFCCC:

1: Scope: The verification report does not provide a conclusion on the verified amount of emission reductions achieved and/or determine that calculations of baseline emissions, project emissions and leakage as appropriate have been carried out in accordance with the formulae and methods described in the monitoring plan and the applied methodology document. (VVM v.1.2 para 208 (c) & 221 (h))

Issue: The DOE is required to provide further information on why the monitored value (0.0405 TJ/t) of NCV of fuel oil was not used for the calculation of the project emission.

TÜV SÜD would like to clarify this issue as follows:

In order to keep the monitoring parameters consistent in the Monitoring Report with the registered PDD, the parameter NCV of fuel oil was mentioned in Monitoring Report by PP among the monitored parameters. It was discussed during onsite visit in details that the only purpose of mentioning this parameter in MR was to ensure the consistency, good quality and completeness of the information. TÜV SÜD confirms that as per the following applied methodology requirement, the monitored values of NCV of fuel oil were not used for the calculation of the project emission and they have no effect on the project emissions of the project activity. Instead of the monitored values of NCV, the default IPCC factor was applied, as indicated in AMS II.B, version 9, §7.

On 26/02/2013 a Request for Review was posed by UNFCCC containing the following two questions: "The DOE is required to justify the calculation of the project emissions in particular: (a) how the use of default value of NCV from the 2006 IPCC is appropriate considering the NCV has been monitored; (b) how it stated that the NCV does not have any effect on the project emission considering the fuel is measured in mass unit and the registered monitoring plan requires the parameter in energy unit. Please refer to VVM v.1.2 para 208 (c)."

Clarification from TÜV SÜD:

- (a) As per methodology AMS II.B (version 9, §7) the calculation of the CO₂-emissions after the CDM project implementation (project emissions) needs the use of a standard emission coefficient, in order to define in energy units the fuel that is used by the

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generation unit. Furthermore the applied methodology indicates IPCC as a possible source for the default factor. According to that, the DOE considers the use of the factor 0.0404 TJ/ton HFO as justified.

In addition for completeness of information:

TÜV SÜD asked from the PP during the verification to demonstrate how also the correct implementation of the MP as per the registered PDD was assured. During the on-site visit the audit team of TÜV SÜD checked the raw data with the daily reports of the laboratory where the NCV of the used Heavy Fuel Oil was measured. TÜV SÜD asked also for the files with all daily reports (IRL 27). The daily results of NCV show for the whole monitoring period an average value of 0.0403 TJ/ton (IRL 41). If this value had been applied in the ER-calculation, a higher number of ERs would have been achieved, because less CO₂ emissions would have been attributed to the power production after implementation of the CDM project. Thus for the 1st verification, the use of the standard factor was a conservative approach.

- (b) The parameter NCV affects indeed the calculation of the project emissions. As per the applied methodology a standard coefficient needs to be used to calculate the energy consumption in the calculation of the CO₂ emissions from the power plant after the implementation of the CDM project. On the other hand the monitored values of this parameter are not used in the calculation. TÜV SÜD apologizes for the misleading previous wording.

In the course of the information and reporting check, the following remark was raised by UNFCCC:

2: Scope: The certification report does not indicate the monitoring period under verification and/or the corresponding number of CERs requested by the DOE. (EB48 Annex 68 para 10 (d))

Issue: The monitoring report indicates that the project emission is 3,275,860.3 tCO₂ and the baseline emission is 3,316,940.8 tCO₂ while the certification report states that the baseline emission is "41,080 t CO₂" and the project emission is "0 t CO₂". The DOE is required to provide further clarification on the different values between the monitoring report and the certification report.

TÜV SÜD would like to clarify this issue as follows:

PP has updated the MR and the emission reduction calculation spreadsheet (IRL 39, 40) and DOE has also updated the Verification and Certification Report. TÜV SÜD confirms that project documents are now consistent with each other.

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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 CDM requirements. All the findings that were raised by the verification team, the responses by the PPs and the conclusion from the team are presented in Annex 1. The means of verification and resulting changes in the MR or related documents are identified in the following table:

CAR 1:

- a. As per EB54, Annex 34 a table with technical information about the cooling tower shall be added in the MR.
- b. In MR Chapter D.2 as per EB48 Annex 68 §10(a)(iv) the calibration frequency and the accuracy of all measuring devices shall be added.
- c. As per EB48 Annex 68 serial numbers and accuracy shall be mentioned also for the meters that were used before the flood.
- d. As per VVM 208(a) the values of the monitored parameters shall be added. For EG and FC sum-values. (if too many then at least annual average values)
- e. As per EB48 Annex 68 7(b) the parameters $CV_{\text{fuel,oil}}$, $\rho_{\text{fuel,oil}}$ according to the registered PDD belong to the monitored parameters. In the GSP MR the parameter $CV_{\text{fuel,oil}}$ is listed as “not monitored” and the parameter $\rho_{\text{fuel,oil}}$ is not mentioned at all. The Greek symbol for density shall be correctly inserted.
- f. Chapter D.1 As per EB48 Annex 68 7(b) the default value for $EF_{\text{CO}_2, \text{fuel, oil}}$ shall be corrected as per PDD
- g. Chapter D.1 As per EB48 Annex 68 7(b) add statement about value 0.0404 in Annex 3 of PDD
- h. Add in the MR for monitored parameters $CV_{\text{fuel, oil}}$ and $\rho_{\text{fuel,oil}}$ if they are used in the ERs-calculation, as per EB48 Annex 68 7(b) which requires consistency between the documents.
- i. It shall be added in the MR in chapter A.8 who is Climate Change Manager, as foreseen in PDD B.7.2.
- j. In chapter A.4 the information regarding metering of flue gases is irrelevant in relation to the monitored parameters and shall be deleted.
- k. In parameter EG in chapter D.2 of MR the mentioning of “fuel consumption” is not in compliance with the mentioned meters. Also the acronyms “LP” and “PG” shall be explained at least once at the beginning of the MR.
- l. Regarding the average value of the NCV during the first monitoring period it shall be mentioned the one as per excel file (0.0403 GJ/t).

CAR 1, means of verification

The revised MR has been checked for compliance with the VVM requirement of consistency within the project documents and transparency in the presented data.

CAR 1, changes in the MR or related documents

A revised MR has been delivered.

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CAR 2:

- a. For both flow meters (one at Lal Pir and one at Pak Gen) as per EB48 Annex 68 §10(a)(v) the following calibration certificates shall be delivered: certificate upon installation (December 2008) and the following yearly certificates. After the on-site audit the DOE received only the one from 14.10.2010.
- b. See also CAR 1 for additional information that shall be added to the MR regarding frequency of measuring, recording, accuracy of instrument and calibration frequency as per VVM§205(c).

CAR 2, means of verification

A complete set of calibration certificates has been asked for and cross-checked against the available information from the on-site audit (e.g. fotos)

CAR 2, changes in the MR or related documents

The MR has been revised and contains all information as required.

CAR 3:

- a. The serial numbers on the eight electricity meters are different than the ones stated on the calibration certificates and the ones stated in the MR. As per EB48 Annex 68 §7(b) it shall be clarified which number can be used for the identification of the eight meters (main and back-up).
- b. The calibration certificate from WAPDA contains only four meters instead of eight. See also CAR 1 for additional information that shall be added to the MR regarding frequency of measuring, recording, accuracy of instrument and calibration frequency, as per EB48 Annex 68 §10(a)(v).

CAR 3, means of verification

A complete set of calibration certificates has been asked for and cross-checked against the available information from the on-site audit.

CAR 3, changes in the MR or related documents

The MR has been revised and contains all information as required.

CAR 4:

A single line diagram of the power plant including the connections to the grid shall be delivered.

CAR 4, means of verification

The single line diagram has been used for further cross check of the situation that was verified on-site.

CAR 4, changes in the MR or related documents

No change in the project documentation occurred.

CAR 5:

- a. Add to the calculation tool the date of completion and the version of the document.
- b. Evidence shall be delivered stating the last day of operation before the flood and the first day of operation after the flood for both sites.

CAR 5, means of verification

The calculation tool has been checked for compliance and the additional evidences as well.

CAR 5, changes in the MR or related documents

The calculation tool has been revised.

CR 1:

As per VVM 195 it shall be clarified if there is a manual explicitly describing the features of the

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|---|
| 8 th additional cooling tower at each site. If it is available, it shall be delivered. |
| CR 1, means of verification |
| PP's response has been evaluated based on the available documents. |
| CR 1, changes in the MR or related documents |
| No change in the project documentation occurred. |

| |
|--|
| CR 2: |
| It shall be clarified if the four electricity meters are bi-directional and if their measurement is net electricity fed into the grid. |
| CR 2, means of verification |
| PP's response has been evaluated based on the available documents. |
| CR 2, changes in the MR or related documents |
| No change in the project documentation occurred. |

| |
|--|
| CR 3: |
| In the document QCD it is explained that the analysis is conducted "batch wise". It shall be further explained. See also CAR 1 for additional information that shall be added to the MR regarding frequency of measuring, recording, accuracy of instrument and calibration frequency. |
| CR 3, means of verification |
| P's response has been evaluated based on the available documents. |
| CR 3, changes in the MR or related documents |
| No change in the project documentation occurred. |

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5 VERIFICATION STATEMENT

TÜV SÜD South Asia Pvt Ltd has performed the first periodic verification of the CDM project: "Construction of additional cooling tower cells at AES Lal Pir (Pvt) Limited. Muzaffar Garh, Pakistan". The verification is based on the currently valid documentation of the UN Framework Convention on Climate Change (UNFCCC).

The management of AES Lal Pir (Pvt.) Limited, Pakistan is responsible for the preparation of the GHG emissions data and the reported GHG emission reductions on the basis set out within the project's Monitoring Plan indicated in the registered PDD version 7, dated 19-12-2008 and the applied methodology AMS II.B, Version 9.

The verifier can confirm that:

- the development and maintenance of records and reporting procedures are in accordance with the registered monitoring plan;
- the project is operated as planned and described in the project design document approved by the EB;
- 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 PDD and monitoring plan approved by the EB;
- the monitoring plan in the approved PDD is as per the applied methodology.

Our opinion is based on the project's GHG emissions and resulting GHG emission reductions reported, which have been both determined through the valid and registered project's baseline, its monitoring plan and its associated documents.

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

Reporting period: From 01-05-2009 to 30-04-2011

Verified emissions in the above reporting period:

| | | |
|----------------------|-------------|--------------------|
| Baseline emissions: | 3.316.940,8 | t CO _{2e} |
| Project emissions: | 3.275.860,3 | t CO _{2e} |
| Leakage emission: | 0 | t CO _{2e} |
| Emission reductions: | 41,080 | t CO _{2e} |

Pune, 15/03/2013

A handwritten signature in black ink, appearing to read 'Egonhutz'.

Certification Body "Environment and Energy"
TÜV SÜD South Asia Pvt Ltd

Annex 1
Verification Protocol

Verification Protocol

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1. Project Activity Implementation

1.1. Technology

| Location | | | |
|---------------------------------------|--|---|---|
| | PDD Description | Verified Situation | Conclusion and IRL |
| Description / Address: | Construction of additional cooling tower cells at AES Lal Pir (Pvt) Limited. Muzaffar Garh, Pakistan. | The location of the site of the CDM project has been confirmed during the on-site visit. | <input checked="" type="checkbox"/> |
| GPS coordinates: | Longitude 70° 59' 51" E Latitude 30° 10' 27" N | Longitude 70.99 E Latitude 30.17 N The Google earth has been used as well as the Blackberry GPS system in order to cross-check the exact coordinates. | <input checked="" type="checkbox"/> |
| Technical Equipment – Main Components | | | |
| | PDD Description | Verified Situation | Conclusion and IRL |
| Description | Installing an additional cooling water tower cell that employs the most advanced technology will result in cooling water with lower temperature than is produced by the current cooling water configuration. Cooler water will lower the heat rate of the system, improving the efficiency of the power plant and resulting to lower CO2 emissions. The project activity used the newest available technology for cooling tower | An additional 8 th cooling water cell has been installed next to the initial seven at each site. The power plant consists of two sites, the Lal Pir site and the Pak Gen site. Each site corresponds to one unit of 365 MW In all cells steam which is generated after the combustion of heavy fuel oil (HFO) is converted to water (it is being condensed) by bringing it into contact with water. Then the water circulates back to the boiler to | <input checked="" type="checkbox"/> IRL 5 IRL 6 IRL 14 |

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| | <p>components such as the gear boxes, Nozzles, fills, and fans. In specific, the nozzles installed whereof a new design which improves the distribution system of the water and helps to reduce the temperature.</p> <p>Technology: The efficiency improvement program under the project activity consists of the following: Construction of additional cooling tower cells.</p> | <p>become again steam through combustion of HFO.</p> <p>On the other hand, the cooling water increases its temperature after condensing the steam but returns to the pipes and there lowers again its temperature to be used again for condensing purposes.</p> | |
| Component 1: Technical Features | New Cooling tower cell for each power unit (365 MW steam turbine) | <p>An additional cooling tower cell per cooling tower at each site has been confirmed on-site. Now, each cooling tower consists of eight cells in total.</p> <p>Following CAR refers strictly to the MR and is result of VVM 190(a), according to which mistakes in the project documentation shall be corrected:</p> <p><u>1. Corrective Action Request</u></p> <ol style="list-style-type: none"> As per EB54, Annex 34 a table with technical information about the cooling tower shall be added in the MR. In MR Chapter D.2 as per EB48 Annex 68 §10(a)(iv) the calibration frequency and the accuracy of all measuring devices shall be added. As per EB48 Annex 68 serial numbers and accuracy shall be | <p><input checked="" type="checkbox"/></p> <p>CAR 1 CR 1</p> <p>IRL 5 IRL 6 IRL 7</p> |

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| | | <p>mentioned also for the meters that were used before the flood.</p> <p>d. As per VVM 208(a) the values of the monitored parameters shall be added. For EG and FC sum-values. (if too many then at least annual average values)</p> <p>e. As per EB48 Annex 68 7(b) the parameters $CV_{fuel, oil}$, $\rho_{fuel, oil}$ according to the registered PDD belong to the monitored parameters. In the GSP MR the parameter $CV_{fuel, oil}$ is listed as “not monitored” and the parameter $\rho_{fuel, oil}$ is not mentioned at all. The Greek symbol for density shall be correctly inserted.</p> <p>f. Chapter D.1 As per EB48 Annex 68 7(b) the default value for $EF_{CO_2, fuel, oil}$ shall be corrected as per PDD</p> <p>g. Chapter D.1 As per EB48 Annex 68 7(b) add statement about value 0.0404 in Annex 3 of PDD</p> <p>h. Add in the MR for monitored parameters $CV_{fuel, oil}$ and $\rho_{fuel, oil}$ if they are used in the ERs-calculation, as per EB48 Annex 68 7(b) which requires consistency between the documents.</p> <p>i. It shall be added in the MR in</p> | |
|--|--|--|--|

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| | | <p>chapter A.8 who is Climate Change Manager, as foreseen in PDD B.7.2.</p> <p>j. In chapter A.4 the information regarding metering of flue gases is irrelevant in relation to the monitored parameters and shall be deleted.</p> <p>k. In parameter EG in chapter D.2 of MR the mentioning of “fuel consumption” is not in compliance with the mentioned meters. Also the acronyms “LP” and “PG” shall be explained at least once at the beginning of the MR.</p> <p>l. Regarding the average value of the NCV during the first monitoring period it shall be mentioned the one as per excel file (0.0403 GJ/t).</p> <p>Chapter A.1 of the MR contains detailed information about the project implementation.</p> <p>Capacity: approximately 4,000 m³/h (see circulating water pump capacity: manual)</p> <p>Manufacturer: Civil construction</p> <p>Commissioning date: December 2008</p> <p>Serial number: N/A</p> <p><u>1. Clarification Request</u></p> <p>As per VVM 195 it shall be clarified if there is a manual explicitly describing the features of the 8th additional cool-</p> | |
|--|--|---|--|

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| | | ing tower at each site. If it is available, it shall be delivered. | |
| Component 2: Technical Features | Nozzles | Manufacturer: Spig Commissioning date: December 2008 | <input checked="" type="checkbox"/> IRL 8 |
| Component 3: Technical Features | Gear box | New gear box per unit with higher thrust capacity. It lowers the speed of the fan. Input 400 rpm, Output 141 rpm Capacity: See on-site & manual Manufacturer: Paramax SFC Commissioning date: December 2008 Serial number: N/A | <input checked="" type="checkbox"/> IRL 8 |
| Operation Status during verification | | | |
| | Verified Situation | | Conclusion and IRL |
| Approvals / Licenses | In operation. | | <input checked="" type="checkbox"/> |
| Actual Operation Status | Start date of operation (each site if applicable): December 2008 Under construction <input type="checkbox"/> In operation <input checked="" type="checkbox"/> Out of operation <input type="checkbox"/> Reason and date (if out of operation): N/A | | <input checked="" type="checkbox"/> IRL 7 |
| | The CDM project has been implemented and is being operated as registered and this has been verified against the technical manual, the final presentation to the board and the log-book commissioning. | | <input checked="" type="checkbox"/> IRL 6 IRL 7 |
| Remarks to Special Operational Status During the Verification Period | Phased implementation: N/A Special cases: During the period 06/08/2010 to 05/11/2010 for Pak Gen and | | <input checked="" type="checkbox"/> |

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| | 06/08/2010 to 23/12/2010 for Lal Pir the whole power plant stopped due to the severe flood in this region of Pakistan. | |
|--|--|--|

1.2. Organization

| Project Participant | | |
|------------------------------|--|-------------------------------------|
| | Verified Situation | Conclusion and IRL |
| Entity / Responsible person: | AES Lal Pir (Pvt.) Limited Mr. Farhan Javed (Operations Manager) Mr. Muhammad Farhan (Performance Engineer) <u>2. Corrective Action Request</u> As per UNFCCC project preview webpage, the information regarding project participant in MR shall be consistent. | <input checked="" type="checkbox"/> |
| CDM Project management: | Mr. Farhan Javed (Operations Manager) Mr. Muhammad Farhan (Performance Engineer) Mr. Zeeshan Talib (Operations engineer) | <input checked="" type="checkbox"/> |

1.3. Quality Management System

| General aspects of the Quality Management System | | |
|--|--|--|
| | Verified Situation | Conclusion and IRL |
| Quality Management Manual: | The Quality Control Document (QCD) which explicitly refers to the cooling tower operation has been delivered to the DOE. The document clearly states which department is | <input checked="" type="checkbox"/> IRL 9 |

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| | responsible for monitoring the respective operations and data. It has been approved by the team leader, Mr. Farhan Javed. | |
| Responsibilities: | Three departments have been designated: CG- Commercial Group; PG – Performance Group; OP - operations Mohammad Farhan: Compilation of data of all monitored parameters Zeshan Talib: Operation of cooling towers | <input checked="" type="checkbox"/> IRL 9 |
| Qualification and Training: | No specific training was required. Only a director had training in Singapore. | <input checked="" type="checkbox"/> |
| Implementation of QM-system | See above QCD | <input checked="" type="checkbox"/> IRL 9 |

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

| Remaining Requests from Previous Verifications | Summary of project owner response | Audit team Conclusion and IRL |
|--|---|-------------------------------|
| Forward action request No. 1: | No FARs was issued in the validation report. There is no FARs from a previous verification because this is the 1st PV. | - |

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2. Monitoring Plan Implementation

2.1. Parameters

| Parameters | | | | | |
|------------|---------------------------|---------------------------|-------------------|--|--|
| Meth/tool | PDD | MR | Included in table | Compliance | Conclusion and IRL |
| N/A | $FC_{\text{fuel oil, y}}$ | $FC_{\text{fuel oil, y}}$ | 2.2 Table 1 | Parameter in MR and calculation tool complies with the PDD | <input checked="" type="checkbox"/> IRL 1 IRL 2 |
| N/A | EG_y | EG_y | 2.2 Table 2 | Parameter in MR and calculation tool complies with the PDD | <input checked="" type="checkbox"/> IRL 1 IRL 2 |
| N/A | $CV_{\text{fuel, oil}}$ | $CV_{\text{fuel, oil}}$ | 2.2 Table 3 | Parameter in MR and calculation tool complies with the PDD | <input checked="" type="checkbox"/> CAR 1 IRL 1 IRL 2 |
| N/A | $\rho_{\text{fuel, oil}}$ | $\rho_{\text{fuel, oil}}$ | 2.2 Table 4 | Parameter in MR and calculation tool complies with the PDD | <input checked="" type="checkbox"/> CAR 1 IRL 1 IRL 2 |

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2.2. Parameters measured directly with instruments

Table 1

| Parameter and instrumentation Information use a separate table for each single instrument (parameters measured with instruments directly on-site shall be included in this tables) | | | | | |
|--|--|-----------|--|---|--|
| | PDD | Meth/Tool | MR | Verified | Conclusion and IRL |
| Parameter title | Yearly consumption of fossil fuel in year "y" by the facility. | N/A | Yearly consumption of fossil fuel in year "y" by the facility. | Parameter in MR consistent with the PDD | <input checked="" type="checkbox"/> |
| Parameter ID (if available) | FC _{fuel oil, y} | N/A | FC _{fuel oil, y} | Parameter in MR consistent with the PDD | <input checked="" type="checkbox"/> |
| Data Unit | TJ | N/A | TJ | Parameter in MR consistent with the PDD | <input checked="" type="checkbox"/> |
| Monitoring frequency (reading) | N/A | N/A | hourly | Parameter in MR consistent with the PDD | <input checked="" type="checkbox"/> |
| Monitoring frequency (recording) | N/A | N/A | hourly | Parameter in MR consistent with the PDD | <input checked="" type="checkbox"/> |
| Calibration requirements | N/A | N/A | No calibration requirements as per manufacturer PP conducts annu- | Flow meter at Lal Pir: 10.11.2008 | <input checked="" type="checkbox"/> CAR 2 IRL 10 IRL 11 |

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|---------------------------------------|--|-----|-------|--|--|
| | | | ally | 08.11.2009 14.10.2010 04.12.2010 (after flood) 16.12.2011 Flow meter at Pak Gen: 10.11.2008 03.09.2009 09.09.2010 09.10.2011 (after flood) | |
| Uncertainty level | N/A | N/A | 0.05% | 0.05% Elite class | <input checked="" type="checkbox"/> CAR 1 IRL 10 IRL 11 |
| Measurement Principle (if applicable) | Micromotion (measures angle) | N/A | N/A | Parameter in MR consistent with the PDD | <input checked="" type="checkbox"/> |
| | Technical aspects | | | | Conclusion and IRL |
| Instrument Type: | Continuous flow meter, Micro motion | | | | <input checked="" type="checkbox"/> |
| Serial Number: | Lal Pir flow meter: 25018667 Pak Gen flow meter: 25018635 | | | | <input checked="" type="checkbox"/> IRL 12 |
| Manufacturer Model Nr.: | Micro Motion Elite | | | | <input checked="" type="checkbox"/> |

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| | | |
|--|---|--|
| | | IRL 11 |
| Specific Location: | One flow meter at each site on the pipeline of HFO | <input checked="" type="checkbox"/> |
| Measurement Range: | 0-120 t/h | <input checked="" type="checkbox"/> |
| Gaps in operating time of instrument : | Period: The flow meter measured continuously throughout the whole MP with the exception of the months where flood caused an interruption of the operation. | <input checked="" type="checkbox"/> |
| | Default value used: N/A | <input checked="" type="checkbox"/> |
| | Justification: N/A | <input checked="" type="checkbox"/> |
| | QA/QC aspects | Conclusion and IRL |
| Source of data | <p>Type: digital</p> <p>According to the MR and the manufacturer's specifications the flow meters shall be calibrated annually.</p> <p>According to VVM 184(a)(ii) calibration frequency and accuracy must be as per manufacturing specifications in order to guarantee quality assurance.</p> <p>3. Corrective Action Request</p> <p>a. For both flow meters (one at Lal Pir and one at Pak Gen) as per EB48 Annex 68 §10(a)(v) the following calibration certificates shall be delivered: certificate upon installation (December 2008) and the following yearly certificates. After the on-site audit the DOE received only the one from 14.10.2010.</p> <p>b. See also CAR 1 for additional information that shall be added to the MR regarding frequency of measuring, recording, accuracy of instrument and calibration frequency as per VVM§205(c).</p> | <input checked="" type="checkbox"/> CAR 2 |
| | <p>Procedures:</p> <p>Hourly measurements are automatically transmitted electronically to the Distributed Control System (DCS) in Central Control Room (CCR). See also daily reports. Addition-</p> | <input checked="" type="checkbox"/> |

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| | | |
|---|---|--------------------|
| | ally it was shown on-site that a monthly cross-check is conducted against manually noted data. On-site a second flow meter is installed for cross-check. Its measurements are mentioned as "flow B" in the raw data. These values deviate slightly since it delivers indirectly the flow values based on a formula. It serves as a reliable second source. Still, only flow A is used for the ERs calculation. | |
| | Implementation of procedure: The use of raw data in the calculation tool has been cross-checked by receiving all raw data for the whole MP. | ☑ |
| | Responsibility: Operations group saves every day the data in a CD and prepares the daily report. Then, the commercial group and performance group verifies at the end of the month. See Quality Control Document. | ☑ IRL 9 |
| Archiving of raw data and protection measures | Raw data are saved in DCS and in CDs. A daily monitoring report is created in electronic form. | ☑ IRL 9 |
| Data transfer and protection of input data for calculations | The raw data are transferred electronically to the calculation tool. The operational personnel is responsible for this duty. | ☑ |
| | Quality of evidence | Conclusion and IRL |
| Completeness of data | Data of fuel consumption cover the whole MP apart from the days during which the plant did not operate due to the flood. | ☑ |
| Data verification | During the on-site audit the audit team conducted a real time check of the current measured value. The displayed value was approximately the same with the value that was automatically saved in the server. The audit team checked in the offices the value at the server a few minutes after having noted down the value of the flow meter. Due to the fact that the values of fuel consumption are recorded hourly, the value of 81 t/h noted at 16:27 deviated slightly from the one seen a bit later at the monitor. The audit team asked and received the hourly raw data for the whole MP. The result between the raw data and the data that are used in the calculation tool are 100% con- | ☑ IRL 16 |

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| | | |
|---------------------------|---|-------------------------------------|
| | sistent. | |
| | Consistency of calculation tool with monitoring report: The MR is consistent with the values of the calculation tool. | <input checked="" type="checkbox"/> |
| Crosscheck (if available) | The values of the flow meter cannot be cross-checked against any other source. | <input checked="" type="checkbox"/> |

Table 2

| Parameter and instrumentation Information | | | | | |
|---|---|-----------|--|---|-------------------------------------|
| | PDD | Meth/Tool | MR | Verified | Conclusion and IRL |
| Parameter title | Net Electricity Generated exported by plant | N/A | Net Electricity Generated exported by plant. | Parameter in MR consistent with the PDD | <input checked="" type="checkbox"/> |
| Parameter ID (if available) | EG _y | N/A | EG _y | Parameter in MR consistent with the PDD | <input checked="" type="checkbox"/> |
| Data Unit | MWh | N/A | MWh | Parameter in MR consistent with the PDD | <input checked="" type="checkbox"/> |
| Monitoring frequency (reading) | N/A | N/A | continuously | Parameter in MR consistent with the PDD | <input checked="" type="checkbox"/> |

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| | | | | | |
|---------------------------------------|--|-----|-------------------------------------|---|--|
| Monitoring frequency (recording) | N/A | N/A | 30 min | Parameter in MR consistent with the PDD | <input checked="" type="checkbox"/> |
| Calibration requirements | N/A | N/A | Grid operator decides the frequency | Parameter in MR consistent with the PDD | <input checked="" type="checkbox"/> CAR 1 |
| Uncertainty level | N/A | N/A | 2% | Parameter in MR consistent with the PDD | <input checked="" type="checkbox"/> CAR 1 |
| Measurement Principle (if applicable) | Electricity meter | N/A | N/A | Parameter in MR consistent with the PDD | <input checked="" type="checkbox"/> |
| | Technical aspects | | | | Conclusion and IRL |
| Instrument Type: | Bi-directional electricity meter <u>2. Clarification Request</u> It shall be clarified if the four electricity meters are bi-directional and if their measurement is net electricity fed into the grid. | | | | <input checked="" type="checkbox"/> CR 2 |
| Serial Number: | Current situation Lal Pir: 46001 and -02 (main meters) 46003 and -04 (back-up) Pak Gen: 42001 and -02 (main meters) 42003 and -04 (back-up) | | | | <input checked="" type="checkbox"/> CAR 3 IRL 13 IRL 24 IRL 25 |

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| | | |
|--|--|--|
| | <p>Before flood</p> <p>LP Main meter line 1: 97280006</p> <p>LP Main meter line 2: 97280005</p> <p>PG Main meter line 1: 97330001</p> <p>PG Main meter line 2: 95490008</p> <p>LP Back-up meter line 1: 97280007</p> <p>LP Back-up meter line 2: 95490003</p> <p>PG Back-up meter line 1: 95490011</p> <p>PG Back-up meter line 2: 95490012</p> <p>See CAR 1 for calibration requirements and accuracy information.</p> <p>Calibrations over the monitoring period:</p> <p>Before flood:</p> <p>Main meters</p> <p>11.02.2009 (LP&PG)</p> <p>Back-up meters</p> <p>22.01.2007 (LP)</p> <p>09.10.2006 (PG)</p> <p>In total 8 meters: 4 main and four back-up at both sites Pak Gen and Lal Pir. All eight meters were visited by TÜV SÜD during the on-site audit; the technical information of each meter was compared with the information included on the calibration certificates in order to identify every single meter. The requirement of quality assurance is defined in VVM 184 (a) (ii).</p> <p><u>4. Corrective Action Request</u></p> <p>a. The serial numbers on the eight electricity meters are different than the ones stated on the calibration certificates and the ones stated in the MR. As per EB48 Annex 68 §7(b) it shall be clarified which number can be used for the identifica-</p> | |
|--|--|--|

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| | <p>tion of the eight meters (main and back-up).</p> <p>b. The calibration certificate from WAPDA contains only four meters instead of eight. See also CAR 1 for additional information that shall be added to the MR regarding frequency of measuring, recording, accuracy of instrument and calibration frequency, as per EB48 Annex 68 §10(a)(v).</p> | |
| Manufacturer Model Nr.: | JEM10 | <input checked="" type="checkbox"/> |
| Specific Location: | <p>Installed at main 220 kV line outlet. In total four connections are installed for exporting electricity to the local distribution grid. The first two are part of the Lal Pir and the other connections belong to Pak Gen.</p> <p><u>5. Corrective Action Request</u></p> <p>A single line diagram of the power plant including the connections to the grid shall be delivered.</p> | <input checked="" type="checkbox"/> CAR 4 |
| Measurement Range: | 0-264 MW | <input checked="" type="checkbox"/> |
| Gaps in operating time of instrument : | Period: applicable for change of instruments and to missing data due to calibration, maintenance or malfunctions; include several periods if necessary separated by / | <input checked="" type="checkbox"/> |
| | Default value used: N/A | <input checked="" type="checkbox"/> |
| | Justification: N/A | <input checked="" type="checkbox"/> |
| | QA/QC aspects | Conclusion and IRL |
| Source of data | Type: data is continuously measured and recorded every 30 min digitally at the meter itself. Monthly these data are retrieved electronically in presence of customer which is the grid. | <input checked="" type="checkbox"/> |
| | Procedures: The data is automatically transmitted and archived electronically. | <input checked="" type="checkbox"/> |
| | Implementation of procedure: On-site it was possible on both days to see how the grid operator conducts the controls of the data. Meter values every 30 min are being retrieved from the meter through the cable and in parallel through internal communication | <input checked="" type="checkbox"/> |

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| | the project owner certifies that the same value is being displayed at their devices in the offices. | |
| | Responsibility: The department of operations (OP) is responsible for archiving the production data of electricity. | <input checked="" type="checkbox"/> IRL 9 |
| Archiving of raw data and protection measures | This data is saved in the server. Grid operator has also the same data. Continuously net production data are transmitted to the plant owner for their own cross check. | <input checked="" type="checkbox"/> |
| Data transfer and protection of input data for calculations | Electronically. | <input checked="" type="checkbox"/> |
| | Quality of evidence | Conclusion and IRL |
| Completeness of data | Data of net electricity generation cover the whole MP apart from the days during which the plant did not operate due to the flood. | <input checked="" type="checkbox"/> |
| Data verification | <p>During the on-site visit the audit team attended an on-site inspection of the grid operator. Purpose of the visit was to check if the transmitted data at the server of Lal Pir are identical with the displayed data at the electricity meters. The result was 100% satisfying. The audit team asked and received the official statement issued by the grid operator.</p> <p>Additionally, TÜV SÜD asked and received the raw data of net electricity production for the whole MP.</p> <p>Moreover TÜV SÜD cross-checked the monthly values of electricity generation against the invoices that were issued by the grid operator who purchases the electricity.</p> | <input checked="" type="checkbox"/> IRL 21 |
| | Consistency of calculation tool with monitoring report The MR is consistent with the values of the calculation tool. | <input checked="" type="checkbox"/> |
| Crosscheck (if available) | N/A | <input checked="" type="checkbox"/> |

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Table 3

| Parameter and instrumentation Information | | | | | |
|---|--|-----------|-----------------------------|--|--------------------|
| | PDD | Meth/Tool | MR | Verified | Conclusion and IRL |
| Parameter title | Measurement of calorific value of the fuel oil consumed during the project activity. | N/A | Net calorific value of Fuel | Parameter in MR consistent with the PDD | ☑ |
| Parameter ID (if available) | CV _{fuel,oil} | N/A | CV _{fuel,oil} | Parameter in MR consistent with the PDD | ☑ |
| Data Unit | GJ/t | N/A | GJ/t | Parameter in MR consistent with the PDD | ☑ |
| Monitoring frequency (reading) | N/A | N/A | Daily | Parameter in MR consistent with the PDD | ☑ IRL 9 |
| Monitoring frequency (recording) | N/A | N/A | daily | Parameter in MR consistent with the PDD | ☑ IRL 9 |
| Calibration requirements | N/A | N/A | 6 months | Latest calibrations: 02.10.2008 01.10.2009 15.11.2010 14.10.2011 02.01.2012 | ☑ IRL 19 |

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| | | | | | |
|--|---|-----|----------|---|---|
| Uncertainty level | N/A | N/A | N/A | Parameter in MR consistent with the PDD | <input checked="" type="checkbox"/> CAR 1 |
| Measurement Principle (if applicable) | N/A | N/A | ASTM 240 | Parameter in MR consistent with the PDD | <input checked="" type="checkbox"/> |
| | Technical aspects | | | | Conclusion and IRL |
| Instrument Type: | Bomb calorie meter | | | | <input checked="" type="checkbox"/> |
| Serial Number: | 1582 | | | | <input checked="" type="checkbox"/> IRL 19 |
| Manufacturer Model Nr.: | Parr 1261 | | | | <input checked="" type="checkbox"/> IRL 19 |
| Specific Location: | In the laboratory at the site. | | | | <input checked="" type="checkbox"/> |
| Measurement Range: | 0-20,000 btu/pound | | | | <input checked="" type="checkbox"/> |
| Gaps in operating time of instrument : | Period: No gaps occurred in the measurement of the calorific value of fuel oil, apart from the period of flood. | | | | <input checked="" type="checkbox"/> |
| | Default value used: N/A | | | | <input checked="" type="checkbox"/> |
| | Justification: N/A | | | | <input checked="" type="checkbox"/> |
| | QA/QC aspects | | | | Conclusion and IRL |
| Source of data | Type: manual and digital | | | | <input checked="" type="checkbox"/> |
| | Procedures: The chemist conducts on a daily basis the analysis and archives electroni- | | | | <input checked="" type="checkbox"/> |

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| | | |
|---|---|---|
| | <p>cally and in paper form the results.</p> <p><u>3. Clarification Request</u></p> <p>In the document QCD it is explained that the analysis is conducted “batch wise”. It shall be further explained. See also CAR 1 for additional information that shall be added to the MR regarding frequency of measuring, recording, accuracy of instrument and calibration frequency.</p> | <p>CR 3</p> <p>IRL 9</p> |
| | Implementation of procedure: DOE asked and received the results of all tests during the MP. | <input checked="" type="checkbox"/> |
| | Responsibility: Plant chemist | <p><input checked="" type="checkbox"/></p> <p>IRL 9</p> |
| Archiving of raw data and protection measures | Data is archived electronically on the server of the company. | <p><input checked="" type="checkbox"/></p> <p>IRL 9</p> |
| Data transfer and protection of input data for calculations | Data is transmitted to the server file manually | <p><input checked="" type="checkbox"/></p> <p>IRL 9</p> |
| | Quality of evidence | Conclusion and IRL |
| Completeness of data | These monitored and recorded data are not used for the calculation of the ERs. They are only monitored for quality assurance as part of the internal procedure. The reason is that applied methodology AMS II.B, version 9, §7 states that a default parameter is needed. | <p><input checked="" type="checkbox"/></p> <p>IRL 9</p> <p>IRL 22</p> <p>IRL 27</p> |
| Data verification | Consistency of raw data with calculation tool: These monitored and recorded data are not used for the calculation of the ERs. | <p><input checked="" type="checkbox"/></p> <p>IRL 9</p> |
| | Consistency of calculation tool with monitoring report: N/A | <input checked="" type="checkbox"/> |

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| | | |
|---------------------------|--|--|
| Crosscheck (if available) | Several random daily reports have been delivered. These values were cross-checked against the electronically transmitted values which can be seen in the daily records and have been found consistent. | <input checked="" type="checkbox"/> IRL 9 IRL 22 IRL 27 |
|---------------------------|--|--|

Table 4

| Parameter and instrumentation Information | | | | | |
|---|--------------------------|-----------|--------------------------|---|--|
| | PDD | Meth/Tool | MR | Verified | Conclusion and IRL |
| Parameter title | Density of fuel oil | N/A | Density of fuel oil | Parameter in MR consistent with the PDD | <input checked="" type="checkbox"/> |
| Parameter ID (if available) | $\rho_{\text{fuel,oil}}$ | N/A | $\rho_{\text{fuel,oil}}$ | Parameter in MR consistent with the PDD | <input checked="" type="checkbox"/> CAR 1 |
| Data Unit | t/m ³ | N/A | t/m ³ | Parameter in MR consistent with the PDD | <input checked="" type="checkbox"/> |
| Monitoring frequency (reading) | N/A | N/A | daily | Parameter in MR consistent with the PDD | <input checked="" type="checkbox"/> |
| Monitoring frequency (recording) | N/A | N/A | daily | Parameter in MR consistent with the PDD | <input checked="" type="checkbox"/> |
| Calibration requirements | N/A | N/A | N/A | N/A | <input checked="" type="checkbox"/> |

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| | | | | | |
|--|--|-----|-----|---|--|
| | | | | | CAR 1 |
| Uncertainty level | N/A | N/A | N/A | Parameter in MR consistent with the PDD | <input checked="" type="checkbox"/> CAR 1 |
| Measurement Principle (if applicable) | N/A | N/A | N/A | Parameter in MR consistent with the PDD | <input checked="" type="checkbox"/> |
| | Technical aspects | | | | Conclusion and IRL |
| Instrument Type: | Hydrometer (density meter) The pressure difference between two points within a vertical column of fluid is directly dependent upon the density of the fluid. This technology is often used for tank gauging applications especially for liquid level and density measure. | | | | <input checked="" type="checkbox"/> |
| Serial Number: | N/A | | | | <input checked="" type="checkbox"/> |
| Manufacturer Model Nr.: | Zeal | | | | <input checked="" type="checkbox"/> |
| Specific Location: | At the tank | | | | <input checked="" type="checkbox"/> |
| Measurement Range: | 0.9-1 | | | | <input checked="" type="checkbox"/> |
| Gaps in operating time of instrument : | Period: No gaps occurred in the measurement of the calorific value of fuel oil, apart from the period of flood. | | | | <input checked="" type="checkbox"/> |
| | Default value used: N/A | | | | <input checked="" type="checkbox"/> |
| | Justification: N/A | | | | <input checked="" type="checkbox"/> |
| | QA/QC aspects | | | | Conclusion and IRL |

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| | | |
|---|---|--------------------------------|
| Source of data | Type: manual | ☑ IRL 9 |
| | Procedures: A sample is taken daily from the tank, the hydro meter is inserted and measures the density. | ☑ |
| | Implementation of procedure: include statement of how the correctness of the procedure implementation has been assessed | ☑ |
| | Responsibility: Plant chemist | ☑ IRL 9 |
| Archiving of raw data and protection measures | Data is saved in the server. | ☑ |
| Data transfer and protection of input data for calculations | Data is transmitted to the server file manually by the plant chemist. | ☑ |
| | Quality of evidence | Conclusion and IRL |
| Completeness of data | These monitored and recorded data are not used for the calculation of the ERs. They are only monitored for quality assurance as part of the internal procedure. | ☑ IRL 9 IRL 22 IRL 27 |
| Data verification | Consistency of raw data with calculation tool: These monitored and recorded data are not used for the calculation of the ERs. | ☑ |
| | Consistency of calculation tool with monitoring report: N/A | ☑ |
| Crosscheck (if available) | Several random daily reports have been delivered. These values were cross-checked against the electronically transmitted values which can be seen in the daily records. | ☑ IRL 22 IRL 27 |

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3. Data Processing and ER calculation

| Description of data processing from transferred data to final results in the calculation tool | | |
|---|--|---|
| Step | Description | Conclusion and IRL |
| Consistency | All abbreviations and units are consistent with PDD and Methodology and are traceable to the raw data | <input checked="" type="checkbox"/> |
| Calculation Tool description | <p>The calculation tool is clearly described and transparent; The second excel sheet contains detailed description of the calculation process. It is also clearly stated which steps of the calculation are directly related to the calculation of the ERs and which are indicated in order to demonstrate the increase in the efficiency of the plant operation.</p> <p>The methodology does not define concrete calculation steps. The calculation tool has been conducted in compliance with the registered PDD.</p> <p>Below the calculation steps are presented for the period May 2009-April 2010:</p> <p>Based on the data of 2007 (they have been validated and are part of the registered PDD) the efficiency of the electricity production is calculated (cell H10). This is done by dividing the electricity production (transformed in TJ) with the fuel consumption.</p> <p>This efficiency factor is used in order to calculate how much fuel consumption would have been necessary to produce the electricity amount that has been actually produced during the project year. This is done by dividing the actual electricity production by this efficiency factor (cell I8).</p> <p>After having calculated the theoretical fuel consumption, the technical losses are calculated by deducting the electricity amount from the fuel consumption. The result of this deduction is the technical losses (cell I9). Finally, the technical losses are multiplied with the fixed emissions coefficient and the theoretical CO₂ emissions are calculated (cell I13).</p> | <input checked="" type="checkbox"/> CAR 5 IRL 4 IRL 16 IRL 17 IRL 18 IRL 22 IRL 26 IRL 28 IRL 29 |

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| | | |
|--|--|-------------------------------------|
| | <p>Based on the actual fuel consumption and electricity generation, as they are measured by the installed equipment, the actual technical losses are calculated (I19). These technical losses are multiplied with the fixed emissions coefficient and the actual CO₂ emissions are calculated (I22).</p> <p>The difference between the theoretical and the actual CO₂ emissions are the ERs that are claimed as CERs (I24).</p> <p><u>6. Corrective Action Request</u></p> <ol style="list-style-type: none"> Add to the calculation tool the date of completion and the version of the document. Evidence shall be delivered stating the last day of operation before the flood and the first day of operation after the flood for both sites. | |
| Elimination of not plausible data (if applicable) | N/A | <input checked="" type="checkbox"/> |
| Transformation from useable data to input data for further calculation (if applicable) | The values that are used in the calculations are the result of the direct measurement from the flow meters and the electricity meters. | <input checked="" type="checkbox"/> |
| Ex-ante data | All baseline data are ex-ante fixed and stem from the last year of operation of the plant without the 8 th cooling tower. The data are from 2007 and will remain fixed throughout the whole crediting period. | <input checked="" type="checkbox"/> |
| Default parameter | Emission Coefficient of CO ₂ per TJ of NCV=77.4 tCO ₂ /TJ Net calorific value of Fuel=0.0404 TJ/tonne | <input checked="" type="checkbox"/> |
| Formulae check | All formulae included in the calculation tool are in compliance with the PDD. | <input checked="" type="checkbox"/> |
| Rounding functions | N/A | <input checked="" type="checkbox"/> |
| Calculation tool changes and protection measures | The calculation tool is being altered only by the PP. Any modifications lies within the jurisdiction of the project owner, no risks are involved in this process. | <input checked="" type="checkbox"/> |
| Reported data | TÜV SÜD confirms the consistency between the results of the calculation tool and the MR. | <input checked="" type="checkbox"/> |

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4. Additional assessment

4.1. Internal Review

| Description and performance of internal review | | |
|--|---|-------------------------------------|
| | Description | Conclusion and IRL |
| Procedure | The final MR and the calculation tool were approved by Mr. Farhan Javed. | <input checked="" type="checkbox"/> |
| Documentation | The internal procedures and responsibilities are documented in the QA/QC as per registered PDD. | <input checked="" type="checkbox"/> |
| Responsibilities | Mr. Farhan Javed | <input checked="" type="checkbox"/> |

4.2. Peculiarities

| Description of Peculiarities and unexpected Daily Events during the verification period | | |
|---|--|-------------------------------------|
| | Description | Conclusion and IRL |
| Performance | The big flood that occurred at the end of 2010 caused an interruption of the plant operation. No CERs are claimed for this period. | <input checked="" type="checkbox"/> |
| Documentation | The approach that has been applied is conservative since no CERs are claimed. | <input checked="" type="checkbox"/> |
| Measures | The plant operation was retrieved as per normal conditions. The operation of the CDM project continued normally together with the rest of the power plant. | <input checked="" type="checkbox"/> |

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4.3. Further additional requirements

| Description of additional requirements to be checked | | |
|--|---|-------------------------------------|
| | Description | Conclusion and IRL |
| e.g. environmental issues | The CDM project has no negative environmental impacts. On the contrary it leads to reduced CO ₂ emissions. | <input checked="" type="checkbox"/> |
| e.g. market price of the product | N/A | <input checked="" type="checkbox"/> |

4.4. Data Reporting

| Description of the Monitoring Report | | |
|--------------------------------------|---|-------------------------------------|
| | Comments and Results | Conclusion and IRL |
| Compliance with UNFCCC regulations | The project documentation is according to the UNFCCC regulations as they were defined in the VVM. The monitoring period starts at the date of registration. | <input checked="" type="checkbox"/> |
| Completeness and Transparency | The MR and the calculation tool are being supported by a series of evidences. | <input checked="" type="checkbox"/> |
| Correctness | All of the provided values correctly transferred from the related and assessed sources (e.g. calculation tool). | <input checked="" type="checkbox"/> |

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5. Compilation and Resolutions of CARs, CRs and FARs

| Corrective Action Requests by audit team | | | |
|--|---|-----|---|
| | Comments and Results | Ref | Conclusion and IRL |
| Issue | <p><u>1. Corrective Action Request</u></p> <ul style="list-style-type: none"> a. As per EB54, Annex 34 a table with technical information about the cooling tower shall be added in the MR. b. In MR Chapter D.2 as per EB48 Annex 68 §10(a)(iv) the calibration frequency and the accuracy of all measuring devices shall be added. c. As per EB48 Annex 68 serial numbers and accuracy shall be mentioned also for the meters that were used before the flood. d. As per VVM 208(a) the values of the monitored parameters shall be added. For EG and FC sum-values. (if too many then at least annual average values) e. As per EB48 Annex 68 7(b) the parameters $CV_{fuel,oil}$, $p_{fuel,oil}$ according to the registered PDD belong to the monitored parameters. In the GSP MR the parameter $CV_{fuel,oil}$ is listed as “not monitored” and the parameter $p_{fuel,oil}$ is not mentioned at all. The Greek symbol for density shall be correctly inserted. f. Chapter D.1 As per EB48 Annex 68 7(b) the default value for $EF_{CO_2, fuel, oil}$ shall be corrected as per PDD g. Chapter D.1 As per EB48 Annex 68 7(b) add statement about value 0.0404 in Annex 3 of PDD h. Add in the MR for monitored parameters $CV_{fuel, oil}$ and $p_{fuel,oil}$ if they are used in the ERs-calculation, as per EB48 Annex 68 7(b) which requires consistency between the documents. i. It shall be added in the MR in chapter A.8 who is Climate Change Manager, as foreseen in PDD B.7.2. j. In chapter A.4 the information regarding metering of flue gases is irrelevant in relation to | 1.1 | <input checked="" type="checkbox"/> IRL 30 |

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| Corrective Action Requests by audit team | | | |
|--|--|----------------|---|
| | <p>the monitored parameters and shall be deleted.</p> <p>k. In parameter EG in chapter D.2 of MR the mentioning of “fuel consumption” is not in compliance with the mentioned meters. Also the acronyms “LP” and “PG” shall be explained at least once at the beginning of the MR.</p> <p>l. Regarding the average value of the NCV during the first monitoring period it shall be mentioned the one as per excel file (0.0403 GJ/t).</p> | | |
| Response | <p>a. (Added in MR under section C with title Technology)</p> <p>b. (Added in MR)</p> <p>c. (MR Updated)</p> <p>d. (Added in MR section D.2)</p> <p>e. (These parameters are monitored only for quality assurance and not used in calculations)</p> <p>f. (Corrected in MR in Table D.1)</p> <p>g. (Data added in MR Section D.1)</p> <p>h. (These parameters are monitored only for quality assurance and not used in calculations)</p> <p>i. Done -- Added in MR (Mr. Farhan Javed is Climate Change Manager)</p> <p>j. Done – Deleted from MR</p> <p>k. Done -- LP & PG explanation added in chapter A.1 in MR.</p> | | |
| Assessment | All necessary revisions have been made in the revised MR. | | |
| Issue | <p><u>2. Corrective Action Request</u></p> <p>As per UNFCCC project preview webpage, the information regarding project participant in MR shall be consistent.</p> | 1.2 of table 1 | <input checked="" type="checkbox"/> IRL 30 |
| Response | MR has been updated as per the information of the project participant presented on UNFCCC project preview webpage. | | |
| Assessment | In updated MR, the information regarding PP consistent with UNFCCC project pre view web-page. | | |

Verification Protocol

Project Title: Construction of additional cooling tower cells at AES Lal Pir (Pvt) Limited. Muzaffar Garh, Pakistan.

Date of Completion: 15/03/2013

Number of Pages: 35



| Corrective Action Requests by audit team | | | |
|--|---|----------------|--|
| Issue | <u>3. Corrective Action Request</u> <ol style="list-style-type: none"> For both flow meters (one at Lal Pir and one at Pak Gen) as per EB48 Annex 68 §10(a)(v) the following calibration certificates shall be delivered: certificate upon installation (December 2008) and the following yearly certificates. After the on-site audit the DOE received only the one from 14.10.2010. See also CAR 1 for additional information that shall be added to the MR regarding frequency of measuring, recording, accuracy of instrument and calibration frequency as per VVM§205(c). | 2.2 Table 1 | <input checked="" type="checkbox"/> IRL 4 IRL 13 IRL 24 IRL 25 |
| Response | As explained during site visit and mentioned in manual of flow meter that calibration is not required for this meter. We have sent the calibration certificates of present meters that are installed after flood. Still, we carryout zero check for these meters, certificate of that calibration is attached. | | |
| Assessment | All calibration certificates (before and after the flood) of all eight electricity meters have been delivered. Also the MR contains no information on accuracy and calibration frequency where applicable. | | |
| Issue | <u>4. Corrective Action Request</u> <ol style="list-style-type: none"> The serial numbers on the eight electricity meters are different than the ones stated on the calibration certificates and the ones stated in the MR. As per EB48 Annex 68 §7(b) it shall be clarified which number can be used for the identification of the eight meters (main and back-up). The calibration certificate from WAPDA contains only four meters instead of eight. See also CAR 1 for additional information that shall be added to the MR regarding frequency of measuring, recording, accuracy of instrument and calibration frequency, as per EB48 Annex 68 §10(a)(v). | 2.2 Table 2 | <input checked="" type="checkbox"/> IRL 13 IRL 24 IRL 25 |
| Response | <ol style="list-style-type: none"> In calibration certificates, there are two numbers, one is S.O Number and other is Serial Number. The numbers mentioned in MR is "Serial Number" or "Meter S/N". Please use "Serial Number" or "Meter S/N" | | |

Verification Protocol

Project Title: Construction of additional cooling tower cells at AES Lal Pir (Pvt) Limited. Muzaffar Garh, Pakistan.

Date of Completion: 15/03/2013

Number of Pages: 35



| Corrective Action Requests by audit team | | | |
|--|--|----------------|--|
| | b. Certificates of remaining meters are available and have been sent. | 2.2 Table 2 | ☑ IRL 20 |
| Assessment | All calibration certificates (before and after the flood) of all eight electricity meters have been delivered. The information is traceable and transparent. | | |
| Issue | <u>5. Corrective Action Request</u> A single line diagram of the power plant including the connections to the grid shall be delivered. | | |
| Response | Drawing attached. | | |
| Assessment | A single line diagram has been delivered to TÜV SÜD. | | |
| Issue | <u>6. Corrective Action Request</u> a. Add to the calculation tool the date of completion and the version of the document. b. Evidence shall be delivered stating the last day of operation before the flood and the first day of operation after the flood for both sites. | 3 | ☑ IRL 4 IRL 28 IRL 29 IRL 30 |
| Response | a. Done – Added in the excel File in ‘Summary’ Sheet b. Done -- Evidence letters already sent to TÜV SÜD. | | |
| Assessment | a. The calculation tool has been revised. b. Both letters to WAPDA have been delivered. | | |
| Clarification Requests by audit team | | | |
| | Comments and Results | Ref | Conclusion and IRL |
| Issue | <u>1. Clarification Request</u> As per VVM 195 it shall be clarified if there is a manual explicitly describing the features of the 8 th additional cooling tower at each site. If it is available, it shall be delivered. | 2.2 Table 1 | ☑ IRL 9 |
| Response | The features of Cooling tower is explained on Page 7 of QCD. | | |

Verification Protocol

Project Title: Construction of additional cooling tower cells at AES Lal Pir (Pvt) Limited. Muzaffar Garh, Pakistan.


Date of Completion: 15/03/2013

Number of Pages: 35




| Corrective Action Requests by audit team | | | |
|--|--|--------------------|-------------------------------------|
| Assessment | Information regarding the cooling tower has been cross-checked against the Quality Control Document. | | |
| Issue | <u>2. Clarification Request</u> It shall be clarified if the four electricity meters are bi-directional and if their measurement is net electricity fed into the grid. | 2.2 Table 2 | ☑ IRL 17 IRL 18 |
| Response | All electricity meters are bi directional, they are measuring export and import in different registers. There output measurement is net electricity fed into the grid. | | |
| Assessment | Issue closed, the electricity meters are of standard type, bi-directional. This has been cross-checked against the raw data sheets. | | |
| Issue | <u>3. Clarification Request</u> In the document QCD it is explained that the analysis is conducted “batch wise”. It shall be further explained. See also CAR 1 for additional information that shall be added to the MR regarding frequency of measuring, recording, accuracy of instrument and calibration frequency. | 2.2 Table 3 | ☑ IRL 10 IRL 11 IRL 15 |
| Response | As explained during site visit calibration was done on annual basis but from this year, we changed its frequency to bi-annual. Calibration certificates were already sent. Similarly record of measured CV and density sent earlier. | | |
| Assessment | The zero calibration certificates as well as the technical specifications of the flow meter have been delivered. | | |
| Forward Action Requests by audit team | | | |
| | Comments and Results | Ref | Conclusion and IRL |
| Issue | <u>Forward Action Request No. 1</u> | | |
| Response | N/A | | |
| Assessment | N/A | | |


Annex 2
Information Reference List

| | | | | |
|--------------|------------|--|----------------|---|
| Final Report | 15-03-2013 | <p>Verification of the CDM Project Construction of additional cooling tower cells at AES Lal Pir (Pvt) Limited. Muzaffar Garh, Pakistan.</p> <p>Information Reference List</p> | Page 1 of 4 |  |
|--------------|------------|--|----------------|---|


| Ref No. | Author/Editor/ Issuer | Title/Type of Document. Publication place | Issuance and/or submission date(dd/mm/yyyy) | Additional Information (Relevance in CDM Context) |
|------------|--------------------------|--|---|--|
| | | <p>Onsite interview (25.04.2012 – 26.04.2012) carried out by TÜV SÜD: Verification Team: Georgios Agrafiotis, TÜV SÜD Verifier Mahmood Syed, TÜV SÜD Technical Expert</p> <p>Interviewed Persons: Mr. Farhan Javed, Operations manager, Lal Pir Mr. Muhammed Farhan, Performance engineer, Lal Pir Zeeshan Talib, Operation engineer, Lal Pir Arshed Khan, Maintenance/Project engineer, Lal Pir Tehseen Ahmed, I&C engineer, Lal Pir Anjad Javed, Plant chemist, Lal Pir Faisal Mahmmod, Electrical engineer, Lal Pir</p> | 25-26.04.2012 | |
| 0. | UNFCCC Webpage | http://cdm.unfccc.int/Projects/DB/SGS-UKL1234427590.22/view | | General information |
| 1. | Lal Pir | PDD, version 7 | 19.12.2008 | General information |
| 2. | Lal Pir | MR, version 1 | 07.12.2011 | General information |
| 3. | UNFCCC Webpage | AMS II.B, version 9 | | General information |
| 4. | Lal Pir | ERs calculation | | Baseline data |
| 5. | Mitsubishi | Contract between Lal Pir and Mitsubishi for construction of initial seven | 31.08.1995 | Contracts/Licenses |

| | | | | |
|--------------|------------|--|----------------|---|
| Final Report | 15-03-2013 | <p>Verification of the CDM Project Construction of additional cooling tower cells at AES Lal Pir (Pvt) Limited. Muzaffar Garh, Pakistan.</p> <p>Information Reference List</p> | Page 2 of 4 |  |
|--------------|------------|--|----------------|---|

| Ref No. | Author/Editor/ Issuer | Title/Type of Document. Publication place | Issuance and/or submission date(dd/mm/yyyy) | Additional Information (Relevance in CDM Context) |
|------------|-----------------------------------|---|---|--|
| | | cooling towers | | |
| 6. | Lal Pir | Presentation of the CDM project | 12.05.2012 | General information |
| 7. | Lal Pir | Log-books for commissioning | 12.05.2012 | Operation start date |
| 8. | Paramax SFC | Gear box manual | 12.05.2012 | Technical information |
| 9. | Lal Pir | Quality Control Document (Environmental, Health and Safety policy) | 2011 | General information |
| 10. | Emerson Micro Motion | Flow meter specification | April 2011 | Technical information |
| 11. | Emerson Micro Motion | Micro Motion MVD9739 manual | June 2010 | Technical information |
| 12. | Micro Motion Inc. | Calibration certificate of flow meters at Lal Pir and Pak Gen | 14.10.2010 | Calibration |
| 13. | WAPDA/AMETEK | Calibration Certificates of electricity meters after flood | 10.05.2012 | Calibration |
| 14. | Lal Pir Berkeley Associates | Contract with Berkeley Associates for the construction of the 8 th cooling tower | 18.08.2007 | Contracts/Licenses |
| 15. | Lal Pir | Certificates of zero calibration of the two flow meters for fuel consumption | 15.06.2012 | Calibration |
| 16. | Lal Pir | Fuel consumption data | 10.05.2012 | Baseline data |
| 17. | Lal Pir | Electricity production data 2009-2010 | 10.05.2012 | Baseline data |
| 18. | Lal Pir | Electricity production data 2011 | 10.05.2012 | Baseline data |
| 19. | Lal Pir | Calibration certificates of calorimeter | 10.05.2012 | Calibration |

| | | | | |
|--------------|------------|--|----------------|---|
| Final Report | 15-03-2013 | <p>Verification of the CDM Project Construction of additional cooling tower cells at AES Lal Pir (Pvt) Limited. Muzaffar Garh, Pakistan.</p> <p>Information Reference List</p> | Page 3 of 4 |  |
|--------------|------------|--|----------------|---|

| Ref No. | Author/Editor/ Issuer | Title/Type of Document. Publication place | Issuance and/or submission date(dd/mm/yyyy) | Additional Information (Relevance in CDM Context) |
|------------|--------------------------|--|---|--|
| 20. | Lal Pir | Single line diagram | 15.06.2012 | Technical information |
| 21. | WAPDA | Electricity ADC Test | 25 & 26.04.2012 | Technical information |
| 22. | Lal Pir | Exemplary daily reports of fuel density and calorific value | 10.05.2012 | Baseline data |
| 23. | Scientific Columbus | Evidence of accuracy class of the power meters | 29.06.2012 | Technical information |
| 24. | AMETEK | Calibration Certificates of back-up electricity meters before flood | | Technical information |
| 25. | AMETEK | Calibration Certificates of main electricity meters before flood | | Technical information |
| 26. | WAPDA | Monthly invoices of energy payment 2009-2011 | | Cross-check of production |
| 27. | Lal Pir | Raw data of density and calorific value of the whole MP | 10.05.2012 | Baseline data |
| 28. | Lal Pir | Letter to WAPDA regarding retrieve of operation of Lal Pir after the flood | 23.12.2010 | General information |
| 29. | Lal Pir | Letter to WAPDA regarding retrieve of operation of Pak Gen after the flood | 05.11.2010 | General information |
| 30. | Lal Pir | MR, version 4 | 20.07.2012 | General information |
| 31. | SPIG S.p.A. | SPIG Report during the planning phase of the 8 th cooling tower | 12.07.2007 | Technical information |
| 32. | Avanceon | Process Hazard Analysis | 25.01.2011 | Technical information |
| 33. | Lal Pir | Conversion of heat rate improvement PKR/hr to Btu/kWh | | Technical information |
| 34. | NTDC | Proof of average available capacity of 350 MW | 27/06/2012 | Technical information |
| 35. | Lal Pir | Production data from 2008 | 14/08/2012 | Technical information |
| 36. | WAPDA | Invoices for production data from 2008 | 17/08/2012 | General information |
| 37. | WAPDA | Energy yearbook 2009 | | Technical information |

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|--------------|------------|--|----------------|---|
| Final Report | 15-03-2013 | <p>Verification of the CDM Project Construction of additional cooling tower cells at AES Lal Pir (Pvt) Limited. Muzaffar Garh, Pakistan.</p> <p>Information Reference List</p> | Page 4 of 4 |  |
|--------------|------------|--|----------------|---|

| Ref No. | Author/Editor/ Issuer | Title/Type of Document. Publication place | Issuance and/or submission date(dd/mm/yyyy) | Additional Information (Relevance in CDM Context) |
|------------|--------------------------|---|---|--|
| 38. | Lal Pir | Confirmation letter that no revamping took place in power plant | 17/08/2012 | Confirmation of no revamping |
| 39. | Lal Pir | MR, version 5 | 15/11/2012 | General information (after information and reporting check) |
| 40. | Lal Pir | Emission reduction calculation sheet version 2 | 15/11/2012 | ER Calculation sheet |
| 41. | Lal Pir | Calculation of NCV based on daily reports | 05/03/2013 | Technical information |
| 42. | Lal Pir | MR, version 6 | 15/03/2013 | General information (Request for review) |

Annex 3
Appointment Certificates



South Asia

CERTIFICATE OF APPOINTMENT

Mr. Mahmood, Khalid fulfills the requirements of the Certification Body "Environment and Energy" of TÜV SÜD South Asia Pvt Ltd to participate in audits.

| Qualification applicable to | | | | | |
|-----------------------------|----------|----|-----|-----|-------|
| Standard | CDM | GS | VCS | VER | Other |
| Date | 21.11.12 | | | | |

| Qualification as | | | | | | |
|------------------|---------|-----------|----------|-------------|--------------------|-----------------------|
| Status | Trainee | Validator | Verifier | Team Leader | Technical Reviewer | Technical Expert |
| Date | | 21.11.12 | 21.11.12 | 21.11.12 | | 1.2, 13.1, 13.2, 15.2 |

| Other qualification | | | | | | |
|---------------------|----------|---|---|---|---|-------|
| Country Expertise | | | | | | |
| Region | 1 | 2 | 3 | 4 | 5 | Other |
| Date | 21.11.12 | | | | | |
| Further countries | | | | | | |
| Financial Expertise | | | | | | |
| Date | | | | | | |

| Qualification in technical areas | |
|--|----------|
| Technical Area | Date |
| 1.2_Energy generation from renewable energy source | 21.11.12 |
| 13.1_Waste handling and disposal | 21.11.12 |
| 13.2_15.2_Animal waste management | 21.11.12 |
| | |
| | |
| | |

This appointment is valid until 28.02.2014 and is bound by internal requirements of the Certification Body "Environment and Energy" of TÜV SÜD South Asia Pvt Ltd.

In case of loss of validity of this certificate as per result of an assessment according to internal procedures or due to any other reason, it will be properly communicated to you.

Your Certificate has the internal reference no. CB-IND-CCP-0028/002.

| Date | Signature |
|------------|-----------|
| 01.03.2013 | |
| | |
| | |



South Asia

CERTIFICATE OF APPOINTMENT

Mr. Agrafiotis, Georgios fulfills the requirements of the Certification Body "Environment and Energy" of TÜV SÜD South Asia Pvt Ltd to participate in audits.

| Qualification applicable to | | | | | |
|-----------------------------|----------|----|-----|-----|-------|
| Standard | CDM | GS | VCS | VER | Other |
| Date | 21.11.12 | | | | |

| Qualification as | | | | | | |
|------------------|---------|-----------|----------|-------------|--------------------|------------------|
| Status | Trainee | Validator | Verifier | Team Leader | Technical Reviewer | Technical Expert |
| Date | | 21.11.12 | 21.11.12 | | | 1.2, 13.1 |

| Other qualification | | | | | | |
|---------------------|----------|---|----------|---|---|-------|
| Country Expertise | | | | | | |
| Region | 1 | 2 | 3 | 4 | 5 | Other |
| Date | 21.11.12 | | 21.11.12 | | | |
| Further countries | | | | | | |
| Financial Expertise | | | | | | |
| Date | 21.11.12 | | | | | |

| Qualification in technical areas | |
|--|----------|
| Technical Area | Date |
| 13.1_Waste handling and disposal | 21.11.12 |
| 1.2_Energy generation from renewable energy source | 21.11.12 |
| | |
| | |
| | |

This appointment is valid until 28.02.2014 and is bound by internal requirements of the Certification Body "Environment and Energy" of TÜV SÜD South Asia Pvt Ltd.

In case of loss of validity of this certificate as per result of an assessment according to internal procedures or due to any other reason, it will be properly communicated to you.

Your Certificate has the internal reference no. CB-IND-CCP-0002/002.

| Date | Signature |
|------------|-----------|
| 01.03.2013 | |
| | |
| | |

CERTIFICATE OF APPOINTMENT

Mr. Syed, Ali Bukhari Mahmood fulfills the requirements of the Certification Body "Environment and Energy" of TÜV SÜD South Asia Pvt Ltd to participate in audits.

| Qualification applicable to | | | | | |
|-----------------------------|----------|----|-----|-----|-------|
| Standard | CDM | GS | VCS | VER | Other |
| Date | 31.01.13 | | | | |

| Qualification as | | | | | | |
|------------------|---------|-----------|----------|-------------|--------------------|------------------|
| Status | Trainee | Validator | Verifier | Team Leader | Technical Reviewer | Technical Expert |
| Date | | | | | | 1.1, 4.1, 4.10 |

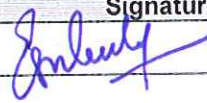
| Other qualification | | | | | | |
|---------------------|----------|---|---|---|---|-------|
| Country Expertise | | | | | | |
| Region | 1 | 2 | 3 | 4 | 5 | Other |
| Date | 31.01.13 | | | | | |
| Further countries | | | | | | |
| Financial Expertise | | | | | | |
| Date | | | | | | |

| Qualification in technical areas | |
|---------------------------------------|----------|
| Technical Area | Date |
| 1.1_4.10_Thermal energy generation... | 31.01.13 |
| 4.1_Cement Sector | 31.01.13 |
| | |
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| | |

This appointment is valid until 28.02.2014 and is bound by internal requirements of the Certification Body "Environment and Energy" of TÜV SÜD South Asia Pvt Ltd.

In case of loss of validity of this certificate as per result of an assessment according to internal procedures or due to any other reason, it will be properly communicated to you.

Your Certificate has the internal reference no. CB-IND-CCP-0068/002.

| Date | Signature |
|------------|---|
| 01.03.2013 |  |
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| | |



South Asia

CERTIFICATE OF APPOINTMENT

Ms. Wagner, Karin fulfills the requirements of the Certification Body "Environment and Energy" of TÜV SÜD South Asia Pvt Ltd to participate in audits.

| Qualification applicable to | | | | | |
|-----------------------------|----------|----|-----|-----|-------|
| Standard | CDM | GS | VCS | VER | Other |
| Date | 21.11.12 | | | | |

| Qualification as | | | | | | |
|------------------|---------|-----------|----------|-------------|--------------------|------------------|
| Status | Trainee | Validator | Verifier | Team Leader | Technical Reviewer | Technical Expert |
| Date | | 21.11.12 | 21.11.12 | 21.11.12 | 21.11.12 | 1.2 |

| Other qualification | | | | | | |
|---------------------|----------|---|---|---|---|-------|
| Country Expertise | | | | | | |
| Region | 1 | 2 | 3 | 4 | 5 | Other |
| Date | 21.11.12 | | | | | |
| Further countries | | | | | | |
| Financial Expertise | | | | | | |
| Date | 21.11.12 | | | | | |

| Qualification in technical areas | |
|--|----------|
| Technical Area | Date |
| 1.2_Energy generation from renewable energy source | 21.11.12 |
| | |
| | |
| | |
| | |

This appointment is valid until 28.02.2014 and is bound by internal requirements of the Certification Body "Environment and Energy" of TÜV SÜD South Asia Pvt Ltd.

In case of loss of validity of this certificate as per result of an assessment according to internal procedures or due to any other reason, it will be properly communicated to you.

Your Certificate has the internal reference no. CB-IND-CCP-0048/002.

| Date | Signature |
|------------|-----------|
| 01.03.2013 | |
| | |
| | |

CERTIFICATE OF APPOINTMENT

Mr. Grugni, Luciano fulfills the requirements of the Certification Body "Environment and Energy" of TÜV SÜD South Asia Pvt Ltd to participate in audits.

| Qualification applicable to | | | | | |
|-----------------------------|----------|----|-----|-----|-------|
| Standard | CDM | GS | VCS | VER | Other |
| Date | 21.11.12 | | | | |

| Qualification as | | | | | | |
|------------------|---------|-----------|----------|-------------|--------------------|---------------------------|
| Status | Trainee | Validator | Verifier | Team Leader | Technical Reviewer | Technical Expert |
| Date | | 21.11.12 | 21.11.12 | | | 1.1, 1.2, 2.2, 4.10, 13.1 |

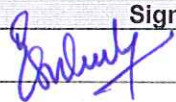
| Other qualification | | | | | | |
|---------------------|----------|---|---|---|---|-------|
| Country Expertise | | | | | | |
| Region | 1 | 2 | 3 | 4 | 5 | Other |
| Date | 21.11.12 | | | | | |
| Further countries | | | | | | |
| Financial Expertise | | | | | | |
| Date | | | | | | |

| Qualification in technical areas | |
|--|----------|
| Technical Area | Date |
| 1.1_4.10_Thermal energy generation... | 21.11.12 |
| 1.2_Energy generation from renewable energy source | 21.11.12 |
| 2.2_Heat distribution | 21.11.12 |
| 13.1_Waste handling and disposal | 21.11.12 |
| | |
| | |

This appointment is valid until 28.02.2014 and is bound by internal requirements of the Certification Body "Environment and Energy" of TÜV SÜD South Asia Pvt Ltd.

In case of loss of validity of this certificate as per result of an assessment according to internal procedures or due to any other reason, it will be properly communicated to you.

Your Certificate has the internal reference no. CB-IND-CCP-0014/002.

| Date | Signature |
|------------|---|
| 01.03.2013 |  |
| | |
| | |
| | |



South Asia

CERTIFICATE OF APPOINTMENT

Mr. Kleiser Thomas fulfills the requirements of the Certification Body "Environment and Energy" of TÜV SÜD South Asia Pvt Ltd to participate in audits.

| Qualification applicable to | | | | | |
|-----------------------------|----------|----|-----|-----|-------|
| Standard | CDM | GS | VCS | VER | Other |
| Date | 21.11.12 | | | | |

| Qualification as | | | | | | |
|------------------|---------|-----------|----------|-------------|--------------------|---------------------|
| Status | Trainee | Validator | Verifier | Team Leader | Technical Reviewer | Technical Expert |
| Date | | 21.11.12 | 21.11.12 | 21.11.12 | 21.11.12 | 1.1, 1.2, 4.1, 4.10 |

| Other qualification | | | | | | |
|---------------------|----------|---|---|---|---|-------|
| Country Expertise | | | | | | |
| Region | 1 | 2 | 3 | 4 | 5 | Other |
| Date | 21.11.12 | | | | | |
| Further countries | | | | | | |
| Financial Expertise | | | | | | |
| Date | 21.11.12 | | | | | |

| Qualification in technical areas | |
|--|----------|
| Technical Area | Date |
| 1.1_4.10_Thermal energy generation.... | 21.11.12 |
| 1.2_Energy generation from renewable energy source | 21.11.12 |
| 4.1_Cement sector | 21.11.12 |
| | |
| | |
| | |

This appointment is valid until 28.02.2014 and is bound by internal requirements of the Certification Body "Environment and Energy" of TÜV SÜD South Asia Pvt Ltd.

In case of loss of validity of this certificate as per result of an assessment according to internal procedures or due to any other reason, it will be properly communicated to you.

Your Certificate has the internal reference no. CB-IND-CCP-0022/002.

| Date | Signature |
|------------|-----------|
| 01.03.2013 | |
| | |
| | |