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Validation Report

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WORLD BANK CARBON FINANCE UNIT

VALIDATION OF CHANGES FROM THE PROJECT ACTIVITY AS DESCRIBED IN THE REGISTERED PROJECT DESIGN DOCUMENT:

“Chacabuquito Hydroelectric Power Project”

UNFCCC **1052**-CDMP

REPORT NO. 1129557

January 13th, 2011

TÜV SÜD Industrie Service GmbH
Carbon Management Service
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Subject: Validation of changes from the project activity as described in the registered project design document			
Accredited TÜV SÜD Unit: TÜV SÜD Industrie Service GmbH Certification Body “climate and energy” Westendstr. 199 - 80686 Munich Federal Republic of Germany		TÜV SÜD Contract Partner: TÜV SÜD Industrie Service GmbH Caron Management Service Westendstr. 199 - 80686 Munich Federal Republic of Germany	
Client: World Bank Carbon Finance Unit 1818 H street NW Washington, DC, USA Further Project Participants: <ul style="list-style-type: none">• Hidroelectrica Guardia Vieja S.A. Av. Apoquindo 4775, Piso 13 Santiago, Chile• DNA of the Netherlands (VROM)• Government of Sweden – Swedish Energy Agency.• GDF Suez. France;• Electrabel S.A, Belgium;• Norsk Hydro ASA. Government of Norway;• Ministry of Foreign Affairs and International Trade. Government of Canada;• Ministry of Foreign Affairs. Norway;• Netherlands’ Ministry of Housing Spatial Planning and the Environment (VROM).		Project Site(s): GPS coordinates: Latitude: 32.853333° S (32°51’12.35” S) Longitude: 70.506111° W (70°30’22.21” W) Los Andes , 5th Region, Chile.	
Project Title: “Chacabuquito Hydroelectric Power Project”			
Applied Methodology / Version: AM0026, version 2		Scope(s): 1 Technical area(s): 1.1	
Registered PDD version: Registration Date: 07-07-2007 Starting Date of Crediting Period : 01-07-2002		Revised PDD: Date of issuance: 03-12-2010 Version: 3.4	
Assessment Team Leader: Johann Thaler Assessment Team Members: Javier Castro, Katrin Hartmann Trainees: Sabina Yunis		Technical Reviewer: Nikunj Agarwal, Thomas Kleiser Responsible Certification Body Members: Thomas Kleiser	

Summary of the Validation Opinion:

- ☒ The reviews of the revised documents and the subsequent follow-up interviews have provided TÜV SÜD with sufficient evidence to determine the fulfilment of all stated criteria. In our opinion, the revised documents provide sufficient evidence to determine that the changes do not raise concerns with respect to aspects outlined in paragraph 10(c) of the “Procedures for notifying and requesting approval of changes from the project activity as described in the registered project design document” (EB48, Annex 66). Hence TÜV SÜD will recommend the acceptance of the changes and allow the subsequent request for issuance.
- ☐ The review of the project design documentation and the subsequent follow-up interviews have not provided TÜV SÜD with sufficient evidence to determine the fulfilment of all stated criteria. Hence TÜV SÜD will not recommend the acceptance of the changes and allow the subsequent request for issuance.

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1 INTRODUCTION

1.1 Objective

The validation objective is an independent assessment by a Third Party (Designated Operational Entity = DOE) of changes from the project activity as described in the PDD as per EB48, Annex 66. Validation is required in the context of any concerns related to the conformity of the actual project activity and its operation with the registered Project Design Document and will finally result in a conclusion by the executing DOE whether the revised documents are appropriate to allow the acceptance of the changes and the subsequent request for issuance. The ultimate decision on the acceptance of the changes and subsequent request for issuance rests at the CDM Executive Board and the Parties involved.

The project activity discussed by this Validation Opinion is registered as CDM activity N° 1052 with the Project Title: “Chacabuquito Hydroelectric Power Project”.

1.2 Scope

The scope of any assessment is defined by the underlying legislation, regulation and guidance given by relevant entities or authorities. The core requirements on changes from the project activity as described in the registered Project Design Document are given by Annex 66 and Annex 67 of the report of EB-48 (See IRL 5 and 6) as referred below:

Paragraph 1: The DOE contracted by the project participant to perform verification shall “identify and inform the project participants of any concerns related to the conformity of the actual project activity and its operation with the registered project design document. Project participants shall address the concerns and supply relevant additional information”.

The validation process is not meant to provide any form of consulting for the project participant (PP). However, stated requests for clarifications and/or corrective actions, and/or forward actions may provide input for improvement of the project design.

2 METHODOLOGY

The project assessment aims at being a risk based approach and is based on the methodology developed in the Validation and Verification Manual, an initiative of Designated and Applicant Entities, which aims to harmonize the approach and quality of all such assessments.

2.1 Appointment of the Assessment Team

According to the technical scopes and experiences in the sectoral or national business environment TÜV SÜD has composed a project team in accordance with the appointment rules of the TÜV SÜD Certification Body “climate and energy”.

The composition of an assessment team has to be approved by the Certification Body (CB) ensuring that the required skills are covered by the team. The Certification Body TÜV SÜD operates four qualification levels for team members that are assigned by formal appointment rules:

- Assessment Team Leader (ATL)
- Greenhouse Gas Validator/Verifier (GHG-V)
- Greenhouse Gas Validator Trainee (T)
- Experts (E)

It is required that the sectoral scope and the technical area linked to the methodology and the project have to be covered by the assessment team.

The validation team was consisting of the following experts (the responsible Assessment Team Leader is written in bold letters):

Name	Qualification	Coverage of sectoral scope	Coverage of technical area	Host country experience
Mr. Johann Thaler	ATL			<input checked="" type="checkbox"/>
Mr. Javier Castro	GHG-V	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Mrs. Sabina Yunis	T			<input checked="" type="checkbox"/>
Katrin Hartmann	GHG-V	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	

Johann Thaler graduated as Master of environmental Economy at the University of Augsburg. During his study he got first experiences in environmental management systems. His master thesis was about a fuel switch program in Brazil as a CDM project. Based in Brazil he has been working for TÜV SÜD as a GHG validator on freelance basis since March 2005. He attended and successfully finished an ISO 14001 Environmental Management Internal Auditing Training.

Javier Castro is head of the International GHG Training and Knowledge Management “Climate and Energy” at TÜV SÜD Industrie Service GmbH and GHG Validator and Verifier. He has an academic background in chemical engineering and energy systems. In his position he participates as project manager the validation, verification and certifications processes for GHG mitigation projects. He has received extensive training in the CDM and JI validation processes, and participated in many validation and verification CDM projects.

Sabina Yunis is environmental engineer and is working as a GHG validator (Trainee) for TÜV SÜD in Argentina. She was involved in several CDM projects activities and is receiving extensive training on all aspects of the Validation and Verification Process. Previously, she submitted a new CDM methodology to the SSC WG (SSC-NM024) “Methodology for using recyclable material instead of virgin material”.

Katrin Hartmann is a validator at the department “TÜV Carbon Management Service” located in the head office of TÜV SÜD Industrie Service GmbH in Munich. She holds a Master’s degree in Business Administration and environmental protection. She worked previously with an international CDM/JI project developer. She has received training in the CDM validation process and participated already in several CDM projects.

2.2 Review of Documents

In order to assess if the change in the installed capacity would impact the additionality of the project activity the revised documents by the client and additional background documents related to additionality aspects were reviewed as initial step of the re-validation process:

- Tool for the demonstration and assessment of additionality. Version 5.2;
- “Dirección General de Aguas – DGA” (Water National Department). Decree N° 281, dated on 15-07-1993;
- “Dirección General de Aguas – DGA” (Water National Department). Decree N° 213, dated on 12-05-1982;
- “Dirección General de Aguas – DGA” (Water National Department). Decree N° 268, dated on 08-07-1993;
- “Results additionality assessment of Chacabiquito.xls”;
- DOSBox 0.73 GOL Program;
- Raw data (regarding the power generation of Chacabiquito) sent by the CNE (*Comisión Nacional de Energía*, National Energy Commission) and by the CDEC-SIC (*Centro de Despacho Económico de Carga*, Load Economic Dispatch Centre);
- Internal data regarding the energy generation of Chacabiquito.

In order to assess if the change in the installed capacity would impact the Scale of CDM project activity or the applicability and application of approved baseline methodology under which the project activity has been registered, a revision of the following documents has been performed:

- Approved baseline and monitoring methodology AM0026, version 02;
- Registered PDD “Chacabiquito Hydroelectric Power Project”, version 3.1, dated on 28-02-2007;
- PDD “Chacabiquito Hydroelectric Power Project”, version 3.2, dated on 11-03-2010;
- PDD “Chacabiquito Hydroelectric Power Project”, version 3.3, dated on 09-08-2010;
- PDD “Chacabiquito Hydroelectric Power Project”, version 3.4, dated on 03-12-2010.

2.3 Follow-up Interviews

According and as a result of the document review, TÜV SÜD discussed with the project participants the revised documentation in an on-site interview on 14/02/2008 and after the on site visit by email and telephone communication.

2.4 Internal Quality Control

As final step of a validation, the Validation Report has to undergo and internal quality control procedure by the Certification Body “Climate and Energy”, i.e. each report has to be approved either by the head of the Certification Body or his deputy. In case one of these two persons is part of the assessment team approval can only be given by the other one.

It rests at the decision of TÜV SÜD's Certification Body whether the revised documents will be submitted for approval by the EB or not.

3 SUMMARY OF FINDINGS

According to paragraph 10 of "Procedures for notifying and requesting approval of changes from the project activity as described in the registered Project Design Document" (EB 48, Annex 66), the DOE shall:

(a) Describe the changes as compared to the description in the registered PDD:

A.4.3 of the registered PDD mentions an installed capacity of 26 MW for renewable electricity generation. During the first periodic verification, the audit team found out that the real installed capacity was much higher, of 28.872 MW (nominal installed capacity). The information tags of the generators inform a power capacity of 8,020 kVA and a power factor of $\cos \phi = 0.9$ each, which results in $8,020 \text{ kVA} \times 0.9 = 7.218 \text{ MW}$ for each generator, thus in total (4 generators) 28.872 MW. See IRL 1, 2 and 3. The revised PDD version 3.4 dated on 03-12-2010 describes two cases, the installed capacity of 28.872 MW as mentioned on the generators and 30 MW installed capacity given by the turbines.

28.872 MW corresponds to the nominal installed capacity mentioned on the generators 30 MW corresponds to the information tags of the turbines that inform a maximum capacity of 30 MW. A conservative approach by assuming the higher value of both values has been followed in the re-assessment of the additionality. Technically the generation will never reach said the highest value for power generation (as per the turbines), only the maximum power generation as given by the generators. The re-assessment of the additionality has been performed for both cases as further explained in this report.

In addition PP changed the gross generation and included the net generation in the revised PDD. Considering a power net generation of 170 GWh, the plant load factor needed to be updated from 0.77 to 0.65, which has been done correctly in the revised PDD as per PLF: $170,000 \text{ MWh} / (30 \text{ MW} \times 8760)$. This last change just addresses the new declared installed capacity, which is less used (loaded) and can be confirmed by the audit team.

All the revised and new information provided in the final PDD version 3.4 was verified by the audit team with the documents mentioned in Annex 1 of this report and by interviews held with the PP, Nelson Saieg (former person, who was responsible for all CDM projects at Colbún S.A.), Jose Andreau (Senior Carbon Finance Specialist at the World Bank and Deal Manager of "Chacabuco Hydroelectric Power Project"), Manuel Betancur (Specialist Engineer in the Management of Planning and Studying) and Cristian Mosella (new responsible for all CDM projects at Colbún S.A.).

(b) Assess on when the changes occurred, reasons for these changes taking place, whether the changes would have been known prior to registration of the project activity, and how the changes would impact the overall operation/ability of the project activity to deliver emission reductions as stated in the PDD:

When the change occurred: during the first verification process, it has been found out that the installed capacity was wrongly described in the registered PDD (<http://cdm.unfccc.int/Projects/DB/DNV-CUK1175238807.52/view>). The change occurred during the development of the original PDD, however only found out during the first periodic verification.

Reason for this change taking place and whether the change would have been known prior to registration of the project activity: the PP has assessed the additionality in the registered PDD based on the maximum permissible power (26 MW) and not based on the nominal power (28.872 MW) described on the generators, even though the nominal power was known prior to the registration of the project. It has been confirmed by the PP that it was their mistake. The reason for this wrongly assessment of the additionality was that “Chacabuquito Hydroelectric Power Plant” is not allowed to produce more power than 26 MW¹ due to physical constraints in the water intake civil works, which allows a maximum inflow of 21.5 m³/s, the nominal flow of the plant. The PP wrongly assumed that this approach based on 26 MW was correct. Nevertheless, minor variations (specified below) in the generation have occurred and could occur in the future. It has been verified (during the first verification audit performed on February 2008 by TÜV SÜD) that the situation aforementioned has happened 63 times from the 2,191 days evaluated from 2002 to 2007, that is to say a 3% of the whole time. The maximum power reached in one situation (between the days aforementioned) was 27.6 MW (see IRL 28). This over-generation has occurred and could occur in the future as a consequence of different operational variables in the load chamber and/or of a higher efficiency in the equipments of the power plant² although the water intake is limited by the dimension of the adduction channel to comply with the water licenses. Water licenses from 1982 and 1993 (see IRL 9, 10, 11) have been issued specifically to this project activity by the “DGA” (Water National Department). The water licenses state an allowed maximum water flow to be captured of 24 m³/s (whenever the river has sufficient water to comply with the ecological flow associated to the water licenses). However, 21.5 m³/s is the current operation water flow. Thus, 26 MW¹ (approx.) are produced at the moment. The 18 m³/s described in the registered PDD version 3.1 corresponds to the flow that is partially taken by the irrigation user and another hydro power plant that is located downstream to Chacabuquito. This power plant has different owners and has no relation with the project activity.

The PP continuously monitors the generation, not the capacity. Nevertheless, the water intake (and consequently the electricity and power generation) is supervised by the DGA (Water National Department) together with “Rio Aconcagua Oversight Committee” who immediately identifies any wrong use of the water rights (see IRL 29).

How the changes would impact the overall operation/ability of the project activity to deliver emission reductions as stated in the PDD: the change in the installed capacity from 26 MW to 28.872 MW does not impact the overall operation/ability of the project activity since, as aforementioned, Chacabuquito Hydroelectric Power Plant is not allowed at the moment to produce more power than 26 MW due to physical constraints in the water intake civil works, therefore the ER claimed in the PDD will not be affected. Although, as per the physical constraints in the water intake civil works the PP cannot produce more than 26 MW, this over-generation could sometimes occur due to the reasons aforementioned. However, the over generation was less than 3% during the period 2002 to 2007, not affecting the ERs. Also, if the over generation occurs, it will never be more than the installed capacity 28.872 MW already assessed in the additionality assessment. If Chacabuquito increases its

¹ The formula used by the PP in the registered PDD to obtain the allowed power (26 MW approx.) to be produced, with a nominal total water flow of 21.5m³/s is the following:

$$Q * H_b * 9.8m^2/s * R_p * R_g * R_t = (21.5m^3/s * 134.58m * 9.8m^3/s * 99.5% * 97.68% * 93.6%) / 1000 = 25.8 \text{ MW (approx 26 MW as described in the registered PDD).}$$

Q: Flow that leads to the system (pipes and turbines). The project consists of 4 pipes and turbines with a nominal flow of 5.375 m³/s each (see IRL 38), a nominal total flow of 21.5 m³/s;

H_b: Net penstock head height at maximum flow (see IRL 35);

9.8m²/s: Gravity constant;

R_p: Transformer efficiency (see IRL 34, 37) R_g: Generator efficiency (see IRL 34, 36); R_t: Turbine efficiency (see IRL 34, 35, 38);

² Confirmed by local experts.

availability of water intake (more than the allowed as per the water licenses, 24 m³/s), the electricity production will not be taken into account for claiming CERs.

(c) Assess, following the guideline by the Board, regarding whether or not the changes would impact the following aspects:

(i) Additionality of the project activity:

The audit team has re-assessed the additionality of the project as per the applied methodology, AM0026 Version 02 based on the documents mentioned in section 2.2.

As per methodology AM0026; "Methodology for zero-emissions grid-connected electricity generation from renewable sources in Chile or in countries with merit order based dispatch grid" Version 02, PP who opt to use step 2 (investment analysis) of the tool "Tool for the demonstration and assessment of additionality" (as it is the case of "Chacabuquito Hydroelectric Power Project") can alternatively use the following approach for this step chosen, provided that they use the optimization model used by the electricity regulatory authority to identify the capacity expansion plan. To demonstrate the additionality of the proposed CDM project, the project proponents shall undertake the following approach:

(i) Run the optimization model where only the power plants identified in the expansion plan are included to estimate the net present cost of energy supply.

(ii) Run the optimization model where the proposed CDM project activity too is included in the expansion plan to estimate the net present cost of energy supply.

(iii) The proposed CDM project activity is additional only if the net present cost of the energy supply estimate in step (ii) above is greater than that estimated in step (i) above.

It has been confirmed (based on the descriptions and evidences mentioned below) that the PP has correctly followed option (iii) for the re assessment of the additionality of "Chacabuquito Hydroelectric Power Project".

Additionality assessed in the registered PDD version 3.1, dated on 28-02-2007 (based on 26 MW): the additionality has been assessed in the registered PDD version 3.1, dated on 28-02-2007 (made public available on: <http://cdm.unfccc.int/Projects/DB/DNV-CUK1175238807.52/view>, IRL 2) based on official data from the CNE (Comisión Nacional de Energía - *National Energy Commission*) and on internal data:

- Values regarding the *operation costs* and the *unserved energy* have been gathered from the DOSBox 0.73 GOL Program (which was the one used by the CNE on April 2001 for the development of the expansion plan) and introduced in an excel file for the NPV calculation. The DOSBox 0.73 GOL Program and the input values (raw data gathered from the CNE) used for running said program have been submitted to the audit team and correctly verified (see IRL 13, 14, 15, 31 and 32). Checks on a random basis of the raw data submitted and the values provided by the DOSBox 0.73 GOL Program have been positive performed.
- Values regarding the *project investment* and the *project O&M costs* have been introduced also in the same excel file. They have been already checked and accepted at the time of validation by the DOE DNV (Det Norske Veritas).

Additionality assessed in the PDD version 3.4, dated on 03-12-2010 (based on 28.872 MW and 30 MW): the original spreadsheet calculation was lost, so the PP has rebuilt it on a new excel file called "Results additionality assessment of Chacabuquito.xls" (see IRL 12) based on the same input data stated in the original PDD. Said calculation tool has been modified by the PP with the new input values (calculated based on internal data and information gathered from CDEC-SIC) related to the nominal installed capacity of 28.872 MW and submitted to the audit team for the re-assessment. The re-assessment of the additionality has been also done for an installed capacity of 30 MW, since the

information tags of the turbines (not the generators) inform a maximum capacity of 30 MW, see IRL 27. A conservative approach has been followed since technically the generation will never reach said power, only the power from the generators. The re-assessment has been performed as follows:

- It has been verified that the values regarding the *project investment* and the *project O&M costs* in “Results additionality assessment of Chacabuco.xls” are the same as the ones used for the assessment based on 26 MW in the original PDD version 3.1 dated on 28-02-2007. It has been verified by the audit team, who crosschecked both documents (original PDD version 3.1 and the revised PDD version 3.4).
- Values regarding the *operation costs* and the *unserved energy* for cases 28.872 MW and 30 MW have been calculated based on information asked by the PP to the CDEC-SIC entity and on internal data. The PP has developed and submitted (as per the procedure “Simplified procedure for running GOL Model”, see IRL 26) an excel file called “Factores de escalamiento P.xls” to convert the power values in energy values in order to introduce them in the DOSBox 0.73 GOL Program for the re assessment of the additionality. Based on the files sent by the official entity CDEC-SIC (Load Economic Dispatch Centre) “IPLP20100131.xls” (see IRL 21) and on internal data “Desarrollo Estratégico HGV 1991-2010.xls” (information used at the time of validation, see IRL 20), the PP developed “Factores de escalamiento P.xls” (see IRL 22). “IPLP20100131.xls” provides the **theoretical power generated** weekly since 1968 to 2007 by Chacabuco Power Plant. Those values were copied and averaged monthly by the PP in “Factores de escalamiento P.xls” in order to obtain the maximum power generated and the adjustment factors. The following approach has been followed and correctly verified by TÜV SÜD:

Max MW (gathered from “IPLP20100131.xls”): **25.9 MW**

Adjustment factors (calculated in “Factores de escalamiento P.xls”):

Case 28.872 MW: $28.872\text{MW} / 25.9\text{MW} = 1.11$

Case 30 MW: $30\text{MW} / 25.9\text{MW} = 1.16$

“IPLP20100131.xls” can be considered reliable since it has been gathered from the official entity of Chile, the Load Economic Dispatch Centre.

The **theoretical energy generated** by Chacabuco gathered from “Desarrollo Estratégico HGV 1991-2010.xls” and used at the time of validation has been weighted with the adjustment factors calculated before (1.11 and 1.16) in an excel file and then converted into “.csv” files (for cases 28.872 MW and 30 MW) called “hidro.csv”. Then, these “.csv” files were introduced in the GOL Program (see IRL 16 and 18) which provides the results (see IRL 17 and 19) for the values regarding the operation costs and the unserved energy for cases 28.872 MW and 30 MW. The CNE provided the rest of the files not modified (same used at the time of validation and indicated in the “Simplified procedure for running GOL Model”) for running the GOL Program). A letter from Colbún S.A. confirming that the information gathered from “Desarrollo Estratégico HGV 1991-2010.xls” is the same as in the original assessment, has been submitted to the DOE. See IRL 25. In addition, the document “Desarrollo Estratégico HGV 1991-2010.xls” has been verified by the audit team running DOSBox 0.73 GOL Program with the input values from said document (without the adjustment factors) and it has been confirmed that the values obtained are the same as in the original PDD, based on 26 MW. See IRL 31.

For the case including the project with a defined installed capacity - case ii) from the Additionality section of the applied methodology:

In the originally assessment (based in 26 MW), the input values (gathered from the CNE) were introduced in the DOSBox 0.73 GOL Program without necessary changes. See IRL 31. For cases based on 28.872 MW and 30 MW the input values (calculated based on information gathered from

CDEC-SIC and on internal data, see IRL 16 and 18) needed to be changed to energy units. The files sent by the CDEC-SIC are not public available, they are only shared between the CDEC-SIC and the PP. Nevertheless, the CDEC-SIC sent a formal e-mail confirming that the values sent regarding the weekly theoretical power generation since 1968 to 2007 by Chacabuco Power Plant are official. See IRL 33.

For the baseline case (without including the project) - case i) from the Additionality section of the applied methodology:

The input values (gathered from the CNE, see IRL 14) were introduced in the DOSBox 0.73 GOL Program without necessary changes. A letter from the CNE (see IRL 24) confirming that the input values for the baseline case (without including the project) are official has been submitted; therefore they can be considered reliable.

A procedure for running DOSBox 0.73 GOL Program in order to verify the correct introduction of the input values in “Results additionality assessment of Chacabuco.xls” has been submitted (see IRL 26). The model has been run by the audit team together with the PP and the results for the cases 28.872 MW and 30 MW (see IRL 17, 19) could be positive checked against “Results additionality assessment of Chacabuco.xls” (see IRL 12), the final file developed for the re-assessment of the additionality.

The assessment done in “Results additionality assessment of Chacabuco.xls” has been correctly introduced in a new version of the PDD called “Chacabuco Hydroelectric Power Project”, version 3.4, dated on 03-12-2010.

In the validated PDD version 3.1, the Costs Difference with an installed capacity of 26 MW [Project Costs – (Generation + Unserved Energy Difference)] is of 7.6 million US\$. That means that “Chacabuco Hydroelectric Power Project” has a reduction in the total costs of the Chile Interconnected Grid System (SIC) of 20.4 million US\$. But, the project costs 28 million US\$ (as per the validated PDD version 3.1); therefore, the project cannot be developed without other revenues.

It is important to highlight that a slight inconsistency in the calculation of the NPV of the Project O&M Costs in the original PDD has occurred (the original PDD stated 2 million US\$, whether it should be 1.7 million US\$). The audit team has verified this inconsistency by checking all cells from the document “Results additionality assessment of Chacabuco.xls” (see IRL 12) and comparing them with version 3.1 of the PDD. Therefore, the Costs Difference with an installed capacity of 26 MW [Project Costs – (Generation + Unserved Energy Difference)] is of 7.3 million US\$, not 7.6 million US\$, however, the project still cannot be developed without other revenues.

Following the same approach as in the validation process, it can be confirmed that in the corrected PDD version 3.4 dated on 03-12-2010 (based on the results from “Results additionality assessment of Chacabuco.xls”), the Costs Difference including the project with an installed capacity of 28.872 MW is of 6 million US\$, and with an installed capacity of 30 MW is of 4.9 million US\$, remaining both > 0. This means that the project has a reduction in the total costs of the Chile Interconnected Grid System (SIC) of 21.7 million US\$ for case 28.872 MW and 22.8 million US\$ for case 30 MW. But, the project costs 27.7 million US\$ (as per the registered PDD version 3.1); therefore, the project is still additional, as it cannot be developed without other revenues.

The proposed CDM project activity is additional since the net present cost of the energy supply estimated as per step (ii) of the applied methodology AM0026 ver02 (see section “Additionality” of AM0026 ver02) is of 1,824 million US\$ (for case 28.872 MW) and 1,822.9 million US\$ (for case 30 MW), both greater than the estimated in step (i) (1,818 million US\$ as per the validated PDD version 3.1) (see IRL 12). Therefore, it has been confirmed that steps i) and ii) from the Additionality section

of the methodology applied (AM0026 “Baseline Methodology for zero-emissions grid-connected electricity generation from renewable sources in Chile or in countries with merit order based dispatch grid” version 02) have been correctly followed in PDD version 3.4 dated on 03-12-2010. Step iii) from the Additionality section of the methodology applied has also been correctly followed, the net present cost of the energy supply estimated in step (ii) above is greater than that estimated in step (i), therefore, the proposed CDM project activity is additional.

It can be confirmed that the change in the installed capacity (EB48, Annex67, paragraph 5-a) indicated in the PDD have no impact on the additionality of the project activity.

(ii) Scale of CDM project activity: The real and verified installed capacity of the project activity does not affect or impact the scale of “Chacabuquito Hydroelectric Power Project” registered under the approved methodology AM0026 version 02, methodology of large scale. See IRL 2 and 7.

(iii) Applicability and application of approved baseline methodology under which the project activity has been registered: The real and verified capacity of the project activity does not impact the applied methodology which continues to be applicable as the most appropriate one and the most appropriate baseline scenario remains the one mentioned in the registered PDD.

The methodology AM0026 version 02 states that it is applicable to proposed electricity capacity additions that meet the following conditions:

- 1) Projects that are renewable electricity generation projects of the following types:
 - 1.1 Run-of-river hydro power plants and hydro electric power projects with existing reservoirs where the volume of the reservoir is not increased;
 - 1.2 New hydro electric power projects with reservoirs having power densities (installed power generation capacity divided by the surface area at the full reservoir level) greater than 4 W/m².
 - 1.3 Wind sources;
 - 1.4 Solar sources;
 - 1.5 Geothermal sources;
 - 1.6 Wave and tidal sources.
- 2) Projects that are connected to the interconnected grids of the Republic of Chile and Projects that fulfils all the legal obligations under the Chilean Electricity Regulation; or
Proposed projects implemented in countries other than Chile provided the country has a regulatory framework for electricity generation and dispatch that meets the following conditions:
 - 2.1 An identifiable independent identity is responsible for optimal operation of the system based on the principle of lowest marginal costs.
 - 2.2 The data for merit order based on marginal costs is publicly made available by the authority responsible for operation of the system.
 - 2.3 The data on specific fuel consumption for each generation source in the system is publicly available.
 - 2.4 It is possible with the information available, to ensure that power plants dispatched for other considerations (e.g. safety conditions, grid stability, transmission constraints, and other electrical reasons) are not identified as marginal plants.

The methodology AM0026 version 02 states that it is not applicable to:

- 1) The proposed CDM project activities that involve switching from fossil fuels to renewable energy at the site of the project activity, and
- 2) If the baseline is the continued use of fossil fuels at the site.

Therefore, the real installed capacity does not impact on the applicability of the approved baseline methodology under which the project activity has been registered. See IRL 2 and 7.

All the requirements from EB 48 - Annex 66 described below have been positive compiled by the PP and assessed by the DOE:

- (a) A clear description of the changes as compared to the description in the registered PDD;
- (b) An assessment on when the changes occurred, reasons for these changes taking place, whether the changes would have been known prior to registration of the project activity, and how the changes would impact the overall operation/ability of the project activity to deliver emission reductions as stated in the PDD;
- (c) An assessment, following the guideline by the Board, regarding whether or not the changes would impact the following aspects:
 - (i) Additionality of the project activity;
 - (ii) Scale of CDM project activity;
 - (iii) Applicability and application of Approved Baseline Methodology under which the project activity has been registered.

4 VALIDATION OPINION

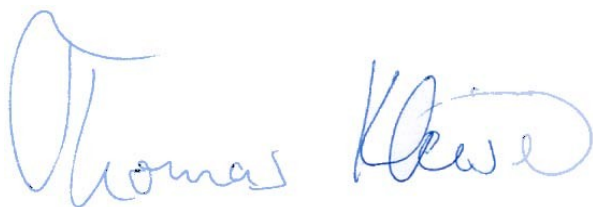
TÜV SÜD has performed a validation of changes from the project activity as described in the registered Project Design Document of the CDM Project 1052:

Chacabuquito Hydroelectric Power Project

The review of the revised documentation and the subsequent follow-up interviews has provided TÜV SÜD with sufficient evidence to determine the fulfillment of all stated criteria. In our opinion, the revised documentation provides sufficient evidence to determine that the changes do not raise concerns with respect to aspects outlined in paragraph 10(c) of the “Procedures for notifying and requesting approval of changes from the project activity as described in the registered project design document”.

Hence TÜV SÜD will recommend the acceptance of the changes and allow the subsequent request for issuance.

Munich, 13-01-2011



Thomas Kleiser
Certification Body “Climate and Energy”
TÜV SÜD Industrie Service GmbH

Munich, 13-01-2011



Johann Thaler
Assessment Team Leader

Annex 1
INFORMATION REFERENCE LIST (IRL)

- 1) Validation Report “Chacabuquito Hydroelectric Power Project”, DNV, Report N°2005-1686, revision N°2, dated on 08-05-2007.
- 2) PDD “Chacabuquito Hydroelectric Power Project”, version 3.1, dated on 28-02-2007
- 3) Photograph taken during the First Periodic Verification of one of the four generators. AVK Deutschland GmbH & Co. KG. D-85051 Ingolstadt. The photograph was taken on 13-02-2008.
- 4) CMD Monitoring Report. Chacabuquito Hydroelectric Power Project. Monitoring period 01 July 2002 to 01 May 2007. Version 3.0 dated on July 2008.
- 5) EB48 Annex 66: “Procedures for notifying and requesting approval of changes from the project activity as described in the registered Project Design Document”.
- 6) EB48 Annex 67: “Guidelines on assessment of different types of changes from the project activity as described in the registered PDD”.
- 7) Approved baseline and monitoring methodology AM0026; “Baseline Methodology for zero-emissions grid-connected electricity generation from renewable sources in Chile or in countries with merit order based dispatch grid” version 02.
- 8) “Tool for the demonstration and assessment of additionality”. Version 5.2
- 9) “Dirección General de Aguas – DGA” (Water National Department). Decree N° 281, dated on 15-07-1993
- 10) “Dirección General de Aguas – DGA” (Water National Department). Decree N° 213, dated on 12-05-1982
- 11) “Dirección General de Aguas – DGA” (Water National Department). Decree N° 268, dated on 08-07-1993
- 12) “Results additioinality assessment of Chacabuquito.xls”.
- 13) DOSBox 0.73 GOL Program.
- 14) Raw data: Input values from the CNE (case baseline, without including the project):
 - hidro.csv
 - fpen.csv
 - datos.csv
 - combusti.csv
 - claves.csv
- 15) “Resul_casobase.txt”. Results for the baseline case.
- 16) New input values developed by the PP based on data gathered from CDEC-SIC, CNE and internal data (case including the project 28.8722 MW):
 - hidro.csv
 - fpen.csv
 - datos.csv
 - combusti.csv
 - claves.csv
- 17) “Resul_28.txt” Results for the case of 28.8722 MW
- 18) New input values developed by the PP based on data gathered from CDEC-SIC, CNE and internal data (case including the project 30 MW):
 - hidro.csv
 - fpen.csv
 - datos.csv
 - combusti.csv
 - claves.csv
- 19) “Resul_30.txt” Results for the case 30 MW.
- 20) “Desarrollo Estratégico HGV 1991-2010.xls”. Energy generated by Chacabuquito since 1961 to 2001 (internal data used at the time of validation).
- 21) “IPLP20100131.xls” sent by CDEC-SIC. Power generated weekly since 1968 to 2007 by Chacabuquito Power Plant.
- 22) “Factores de escalamiento P.xls” developed by Colbún S.A.

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- 23) PDD “Chacabquito Hydroelectric Power Project”, version 3.2, dated on 11-03-2010.
- 24) Letter from the CNE confirming that all input values are official.
- 25) Letter from Colbún S.A. confirming that the information used in the new additionality assessment is the same used in the original assessment.
- 26) “Procedimiento simplificado para simulaciones con el modelo GOL (Gestión Optima del Laja) de despacho hidrotérmico” (Simplified procedure for running DOSBox 0.73 GOL Program).
- 27) Information tags of the turbines. (VATECH)
- 28) “Annex 9_potencias-caudales.xls”. Excel file submitted at the time of the first verification audit performed by TÜV SÜD on February 2008.
- 29) Certification of well use of water licenses. Issued by “Rio Aconcagua Oversight Committee”. Dated on 08-07-2008.
- 30) PDD “Chacabquito Hydroelectric Power Project”, version 3.3, dated on 09-08-2010.
- 31) Input values based on data gathered from CNE (case including the project 26 MW):
 - hidro.csv
 - fpen.csv
 - datos.csv
 - combusti.csv
 - claves.csv
- 32) “Resul_26.txt” Results for the case of 26 MW.
- 33) E-mail sent by the CDEC-SIC (Load Economic Dispatch Centre) dated on 12-03-2010 confirming that the input values regarding the weekly power generation since 1968 to 2007 by Chacabquito Power Plant are official.
- 34) “Project Design Document Changes Justification”. Colbún. Submitted on 26-10-2010.
- 35) Comparison of the Test Results with the Guarantee,(VATECH). Evidence of parameter Rt (turbine efficiency) and “H”.
- 36) “Protocolo de pruebas para alternadores trifásicos autoregulados”. Test report for self regulating three phase alternator. Evidence of parameter Rg (generator efficiency). AVK. Deutschland GmbH & Co.KG.
- 37) Test protocol. Evidence of parameter Rp (transformer efficiency). TOSHIBA.
- 38) Operational and Maintenance Manual. Francis Turbines. VATECH.
- 39) PDD “Chacabquito Hydroelectric Power Project”, version 3.4, dated on 03-12-2010.