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# VALIDATION REPORT

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## CHILE: QUILLECO HYDROELECTRIC PROJECT

REPORT No. 2007-0812

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DET NORSKE VERITAS



## VALIDATION REPORT

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DET NORSKE VERITAS  
CERTIFICATION AS

Veritasvegen 1  
N-1322 Høvik  
Norway  
Tel: +47 6757 9900  
Fax: +47 6757 9911  
<http://www.dnv.com>

### Summary:

Det Norske Veritas Certification AS (DNV) has performed a validation of the “Chile: Quilleco Hydroelectric Project” on the basis of UNFCCC criteria for the CDM, as well as criteria given to provide for consistent project operations, monitoring and reporting. UNFCCC criteria refer to Article 12 of the Kyoto Protocol, the CDM modalities and procedures and the subsequent decisions by the CDM Executive Board. This validation report summarizes the findings of the validation.

The validation consisted of the following three phases: i) a desk review of the project design documents, ii) follow-up interviews with project stakeholders and iii) the resolution of outstanding issues and the issuance of the final validation report and opinion.

In summary, it is DNV’s opinion that the “Chile: Quilleco Hydroelectric Project”, as described in the project design document version 2.1 of 27 June 2008, meets all relevant UNFCCC requirements for the CDM and correctly applies the approved baseline and monitoring methodology AM0026 (Version 2 of 19 May 2006) - “Methodology for zero-emissions grid-connected electricity generation from renewable sources in Chile or in countries with merit order based dispatch grid” Hence, DNV requests the registration of the “Chile: Quilleco Hydroelectric Project” as a CDM project activity.

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## ***Abbreviations***

CAR	Corrective Action Request
CDEC-SIC	Economic Dispatch Center in the Central Interconnected System
CDM	Clean Development Mechanism
CEF	Carbon Emission Factor
CER	Certified Emission Reduction
CH <sub>4</sub>	Methane
CL	Clarification request
CNE	National Energy Commission
CO <sub>2</sub>	Carbon dioxide
CO <sub>2</sub> e	Carbon dioxide equivalent
DNV	Det Norske Veritas
DNA	Designated National Authority
EIA	Environmental Impact Assessment
GHG	Greenhouse gas(es)
GWP	Global Warming Potential
HGV	Hidroeléctrica Guardia Vieja
IBRD	International Bank for Reconstruction and Development
IPCC	Intergovernmental Panel on Climate Change
MP	Monitoring Plan
MVP	Monitoring and Verification Plan
N <sub>2</sub> O	Nitrous oxide
NCDMF	Netherlands Clean Development Mechanism Facility
NGO	Non-governmental Organisation
ODA	Official Development Assistance
PDD	Project Design Document
UNFCCC	United Nations Framework Convention on Climate Change



## 1 INTRODUCTION

The International Bank for Reconstruction and Development has commissioned Det Norske Veritas Certification AS (DNV) to perform a validation of the “Chile: Quilleco Hydroelectric Project” in Chile (hereafter called “the project”).

This report summarizes the findings of the validation of the project, performed on the basis of UNFCCC and host Party criteria for CDM projects, as well as criteria given to provide for consistent project operations, monitoring and reporting.

The validation team consisted of the following personnel:

Mr. Felipe Antunes	DNV Porto Alegre	Team Leader, GHG auditor
Mr. Luis Filipe Tavares	DNV Rio de Janeiro	CDM validator
Mr. Einar Telnes	DNV Oslo	Energy sector expert;
Mr. Hendrik W. Brinks	DNV Oslo	Technical reviewer

### 1.1 Validation Objective

The purpose of a validation is to have an independent third party assess the project design. In particular, the project's baseline, the monitoring plan, and the project's compliance with relevant UNFCCC and host Party criteria are validated in order to confirm that the project design as documented is sound and reasonable and meets the identified criteria. Validation is a requirement for all CDM projects and is seen as necessary to provide assurance to stakeholders of the quality of the project and its intended generation of certified emission reductions (CERs).

### 1.2 Scope

The validation scope is defined as an independent and objective review of the project design document (PDD). The PDD is reviewed against the criteria stated in Article 12 of the Kyoto Protocol, the CDM modalities and procedures as agreed in the Marrakech Accords and the relevant decisions by the CDM Executive Board, including the approved baseline and monitoring methodology AM0026 (Version 2 of 19 May 2006) /17/. The validation team has, based on the recommendations in the Validation and Verification Manual /16/, employed a risk-based approach, focusing on the identification of significant risks for project implementation and the generation of CERs.

The validation is not meant to provide any consulting towards the project participants. However, stated requests for clarifications and/or corrective actions may have provided input for improvement of the project design.

### 1.3 Description of Proposed CDM Project

The “Chile: Quilleco Hydroelectric Project” consists of a run-of-river power plant with 70 MW capacity that utilizes the water discharged by the Rucúe hydropower plant. The project will generate approximately 422 GWh per year and will dispatch 47 MW of base power to the SIC electric grid (Sistema Interconectado Central).

The project developer and operator is Colbún S.A., the second largest electric holding company in Chile. In the third quarter of 2005 Colbún acquired Cenelec S.A. and Hidroeléctrica Guardia



Vieja S.A. (HGV). HGV still operates as a subsidiary of Colbún and will be acting as the project sponsor, representing Colbún S.A. for all CDM activities.

Estimated GHG emission reductions from the project are 1 205 232 tonnes CO<sub>2</sub> equivalent (tCO<sub>2</sub>e) during the 7 years crediting period, which results in estimated average annual emission reductions of 172 176 tCO<sub>2</sub>e.

## 2 METHODOLOGY

The validation consisted of the following three phases:

- I a desk review of the project design documents;
- II follow-up interviews with project stakeholders;
- III the resolution of outstanding issues and the issuance of the final validation report and opinion.

In order to ensure transparency, a validation protocol was customized for the project, according to the Validation and Verification Manual /16/. The protocol shows in transparent manner criteria (requirements), means of verification and the results from validating the identified criteria. The validation protocol serves the following purposes:

- It organises, details and clarifies the requirements a CDM project is expected to meet;
- It ensures a transparent validation process where the validator will document how a particular requirement has been validated and the result of the validation.

The validation protocol consists of three tables. The different columns in these tables are described in Figure 1.

The completed validation protocol for the “Chile: Quilleco Hydroelectric Project” is enclosed in Appendix A to this report.

Findings established during the validation can either be seen as a non-fulfillment of validation protocol criteria or where a risk to the fulfillment of project objectives is identified. Corrective action requests (CAR) are issued, where:

- i) mistakes have been made with a direct influence on project results;
- ii) validation protocol requirements have not been met; or
- iii) there is a risk that the project would not be accepted as a CDM project or that emission reductions will not be certified.

The term clarification may be used where additional information is needed to fully clarify an issue



<b>Validation Protocol Table 1: Mandatory Requirements for CDM Project Activities</b>			
<b>Requirement</b>	<b>Reference</b>	<b>Conclusion</b>	<b>Cross reference</b>
The requirements the project must meet.	Gives reference to the legislation or agreement where the requirement is found.	This is either acceptable based on evidence provided ( <b>OK</b> ), a <b>Corrective Action Request (CAR)</b> of risk or non-compliance with stated requirements or a request for <b>Clarification (CL)</b> where further clarifications are needed.	Used to refer to the relevant checklist questions in Table 2 to show how the specific requirement is validated. This is to ensure a transparent Validation process.

  

<b>Validation Protocol Table 2: Requirement Checklist</b>				
<b>Checklist Question</b>	<b>Reference</b>	<b>Means of verification (MoV)</b>	<b>Comment</b>	<b>Draft and/or Final Conclusion</b>
The various requirements in Table 1 are linked to checklist questions the project should meet. The checklist is organised in seven different sections. Each section is then further sub-divided. The lowest level constitutes a checklist question.	Gives reference to documents where the answer to the checklist question or item is found.	Explains how conformance with the checklist question is investigated. Examples of means of verification are document review (DR) or interview (I). N/A means not applicable.	The section is used to elaborate and discuss the checklist question and/or the conformance to the question. It is further used to explain the conclusions reached.	This is either acceptable based on evidence provided ( <b>OK</b> ), or a <b>Corrective Action Request (CAR)</b> due to non-compliance with the checklist question (See below). A request for <b>Clarification (CL)</b> is used when the validation team has identified a need for further clarification.

  

<b>Validation Protocol Table 3: Resolution of Corrective Action Requests and Requests for Clarification</b>			
<b>Draft report corrective action requests and requests for clarifications</b>	<b>Ref. to Table 2</b>	<b>Summary of project participants' response</b>	<b>Final conclusion</b>
If the conclusions from the draft Validation are either a <b>Corrective Action Request</b> or a <b>Clarification Request</b> , these should be listed in this section.	Reference to the checklist question number in Table 2 where the <b>Corrective Action Request</b> or <b>Clarification Request</b> is explained.	The responses given by the project participants during the communications with the validation team should be summarised in this section.	This section should summarise the validation team's responses and final conclusions. The conclusions should also be included in Table 2, under "Final Conclusion".

**Figure 1: Validation protocol tables**



## 2.1 Review of Documents

The PDD (version 2.1 of 27 June 2008) /7/ submitted by the International Bank for Reconstruction and Development, the previous versions of the PDD /1/ - /5/ as well as other supporting documents submitted by the project developer /8/ - /13/ were assessed by DNV as a part of the validation.

## 2.2 Follow-up Interviews

DNV performed interviews with project stakeholders on April - July 2007 to confirm selected information and to resolve issues identified in the document review. Representatives of the International Bank for Reconstruction and Development were interviewed /20/ /21/. The main topics of the interviews are summarised in Table 1.

**Table 1 Interview topics**

Interviewed organisation	Interview topics
International Bank for Reconstruction and Development	<ul style="list-style-type: none"><li>➤ Environmental Licenses</li><li>➤ Consultation of local stakeholders</li><li>➤ Additionality of the project</li><li>➤ Baseline emission calculations</li><li>➤ Emission factor calculation</li></ul>

## 2.3 Resolution of Clarification and Corrective Action Requests

The objective of this phase of the validation was to resolve any outstanding issues which needed to be clarified for DNV's positive conclusion on the project design.

The initial validation of the project identified 15 requests for clarification. The project participant's response to DNV's initial validation report findings and the final version of the PDD (version 2.1 of 27 June 2008) addressed the requests for clarification to DNV's satisfaction.

To guarantee the transparency of the validation process, the concerns raised and the response provided by the project participants are documented in more detail in the validation protocol in Appendix A.

## 2.4 Internal Quality Control

The draft validation report including the initial validation findings underwent a technical review before being submitted to the project participants. The final validation report underwent another technical review before requesting registration of the project activity. The technical review was performed by a technical reviewer qualified in accordance with DNV's qualification scheme for CDM validation and verification.





### 3 VALIDATION FINDINGS

The findings of the validation are stated in the following sections. The validation criteria (requirements), the means of verification and the results from validating the identified criteria are documented in more detail in the validation protocol in Appendix A.

#### 3.1 Participation Requirements

The project participants are Hidroelectrica Guardia Vieja AS, International Bank for Reconstruction and Development (IBRD) as Trustee of the Netherlands Clean Development Mechanism Facility (NCDMF) and the Netherlands. The host Party Chile and the Annex I Party the Netherlands meet all relevant participation requirements.

The Chilean DNA has issued the LoA on 31 August 2005 authorizing Hidroelectrica Guardia Vieja AS as project participant and confirmed that the project is contributing to sustainable development in Chile /14/.

The DNA of the Netherlands has issued the LoA on 13 January 2006, authorizing the International Bank for Reconstruction and Development as project participant /15/.

The validation did not reveal any information that indicates that the project can be seen as a diversion of ODA funding towards Chile.

#### 3.2 Project Design

The Chile: Quilleco Hydroelectric Project consists of a run-of-river power plant that utilizes the water discharged by the Rucúe hydropower plant (130 m<sup>3</sup>/s). The project will generate approximately 422 GWh per year and will dispatch 47 MW of firm power to the SIC electric grid (Sistema Interconectado Central).

The project design engineering reflects good practice /10/. It comprises of a 4.4 km long concrete channel, 3.2 km aqueduct tunnel, 105 m pressure penstock of 59.4 m height, a power house with two sets of 35 MW vertical Francis turbines/generators, 13.8/220 kV power transformer and 300 m of 220 kV double circuit line connected to the existing 220 kV double circuit transmission line to the high voltage Charrúa substation in the Central Interconnected System (SIC).

The methodology AM0026, version 2, is applicable to the proposed project activity as the project is a run-of-river hydro power plant and the project is connected to the interconnected grids of the Republic of Chile.

By promoting renewable energy, the project is likely to contribute to sustainable development in Chile. This has been confirmed by the Chilean DNA in its LoA issued on 31 August 2005 /14/.

A 7 years renewable crediting period is selected, starting on 01 July 2008 (or the registration date if later). The starting date of the project activity is 26 October 2004, corresponding to the project approval /11/. The expected operational lifetime of the project is over 30 years.



### 3.3 Baseline Determination

The project applies the approved baseline 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 2 of 19 May 2006 /17/.

The baseline scenario is that electricity delivered to the grid by the project would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM). The operating margin (OM) and build margin (BM) emission coefficient for the project will be determined annually *ex-post* from the dispatch data obtained from the Economic Dispatch Center in the Central Interconnected System (CDEC-SIC) and data by the National Energy Commission (CNE).

The baseline determination is transparent and deemed reasonable.

### 3.4 Additionality

As required by AM0026, the four steps of the “Tool for demonstration and assessment of additionality” version 3 have been applied to demonstrate the additionality of the project:

Step 1: The alternatives to the project were evaluated by running an optimisation model by the CNE. The identification of alternatives to the project activity is based on the Chilean national authority indicative expansion plan. According to this plan, the least cost alternative for the expansion of the SIC are combined cycle natural gas fired power plants and a hydro dam called Neltume (400 MW, 2011). The rest of the projects are renewable energy CDM projects such as Hornitos in the fifth region, La Higuera and the Calabozo geothermal plant. This model demonstrates that the Quilleco Hydroelectric Project is not the only alternative for the expansion of the system and nor the least cost alternative, which are combined cycle natural gas fired power plants and hydro dams (not run-of-river).

Step 2: An investment analysis is selected to demonstrate the additionality of the project. For this, a cost analysis model is run once with the baseline situation predicted by the expansion plan and once including the project situation. According to AM0026, the proposed CDM project activity is additional only if the net present cost of the energy supply estimate considering the project situation is greater than that estimated considering the baseline situation. A 10% discount rate is used, as this is the official rate for the Chilean electric sector, used by the CNE to determine system prices with the expansion model /12/. The comparison of both scenarios shows that the project would reduce system operation cost in US\$ 36.0 million, reduce the expected shortage of US\$ 13.8 million and would add a cost of US\$ 55.5 million for additional investment and maintenance of the project. This represents an overall outcome of 5.7 millions USD, which demonstrates that the project would be additional. At the project level, the project had all its legal procedures accomplished since year 2000, after the approval of the EIA by CONAMA (the National Environmental Agency). However, the project did not reach the company's board approval for implementation until 26 October 2004, due to the low expected rate of return /11/. Before its approval the project developer submitted this project to the World Bank seeking for additional funding from the emissions reductions generated by the project. The CDM was seriously considered before the approval of the project (26 October 2004) /11/ and the expected revenues from the CDM component of the project and the Netherlands Clean Development Mechanism Facility (NCDMF) as buyer were crucial for the investment decision. The Colbun Board meeting of 26 October 2004 clearly addresses the CDM revenues /11/.



The input values used in the investment analysis were validated using two main sources:

- All the project costs were confirmed in the budget presented in the Feasibility Study from Colbun S.A. dated April 1998. This cost was used without any correction for inflation up to April 2004, which is conservative considering that the costs likely have increased during these six years, reducing the financial viability of the project. The April 2004 cost was corrected to 2007/2008 by the discount rate of 10% used in the investment analysis. The investment costs and operating and maintenance costs (both relative to investment and MW) are considered realistic compared to other hydropower projects validated by DNV;
- The alternative approach of step 2 of the additionality tool for AM0026 was used: Comparison of net present cost of the energy supply with and without the project. The optimization model used by the electricity regulatory authority of Chile to identify the capacity expansion plan was used. The costs of generation and unserved energy from the grid was confirmed by checking the calculus from the expansion plan from the CNE (National Energy Commission) and the correspondent original data of generation and unserved energy costs (<http://www.cne.cl/>). The costs calculation model and the input data used are used for approvals for additions to generation capacity in Chile. The model and the input data are thus from an official and recognized source and form the basis for decision making. DNV has thus not further validated the model and the input data used.
- The discount rate of 10% is the official discount rate by CNE.

Step 3: Not selected.

Step 4: Run of the river hydro plants are not a common practice in Chile. It is confirmed that prior to Quilleco only a few run-of-river hydro plants were developed in the SIC. The Chacabucito hydro project was built in 2001 (26 MW), is a CDM project activity, thus additional to the baseline.

The following timeline presents the implementation of the project.

- July 2004: Submission of project PIN to the International Bank of Reconstruction and Development (IBRD) /16/.
- 22 September 2004: The project developer and the IBRD signed a Letter of Intent with regard to the purchase and sale of emission reductions that were to aid the project finance /17/.
- 26 October 2004: The Board of Colbun approves definitely the project considering CDM benefits /11/.
- 15 November 2004: The contract with Züblin International GmbH Chile Ltd. is signed for tunnel civil works /18/.
- 1 March 2005: The contract with Power Machines – ZTL, LMZ, Elektrosila, Emergomaschexport was signed for electro-mechanical equipment supply and assemble /19/.

The first official restrictions of Natural Gas from Argentina started on March 2004, with the issuance of official Regulations and Disposals restricting volume exported in case of internal needs. However, according to the October 2004 Node Price Report /12/ issued by the Chilean CNE (Energy National Commission), those first restrictions did not affect the energy price, which at that time was 43.29 USD/MWh. The node price is an indicator of the expectations of



the Chilean Energy Nation Commission for the next half year and is decisive for approval of new power plants.

In April 2005, the CNE Node Price Report /12/ accounted some natural gas restrictions in its long term model. However, the restrictions, which were the most plausible scenario that could be projected by the authority, did not represent any big impact in the system price, which was about 38.23 USD/MWh.

Finally, although the restriction scenario had not changed substantially, the October 2005 CNE Node Price Report /12/ establishes a price of 62.49 USD/MWh. This happened because of the high increase of the diesel price, which is used as an alternative combustible in case of gas restrictions. However, this was a long time after the project participants had committed funds to the implementation of the project.

Based on the evidences provided, DNV could confirm that the gas restrictions from Argentina did not affect the project's implementation, considering that the first financial commitment occurred on 15 November 2004 and the price increases due to gas restrictions were only seen on October 2005. Therefore it is DNV's opinion that the project is additional to what would otherwise have occurred.

### 3.5 Monitoring Plan

The project applies the approved monitoring methodology AM0026 (Version 2 of 19 May 2006) - "Methodology for zero-emissions grid-connected electricity generation from renewable sources in Chile or in countries with merit order based dispatch grid" /17/.

The emission reductions will be calculated from the amount of electricity generated by the project and the combined margin emission coefficient of the SIC grid. To calculate the emission coefficient the following key parameters will be monitored and updated from dispatch data:

- Actual amount of electricity delivered to the grid by individual power plants on an hourly basis
- Dispatch order of power plants
- Fuel usage in individual power plants.

Details of the data to be collected, the frequency of data recording and its format are clearly described in the monitoring plan and deemed to be adequate. The authority and responsibility for project management, monitoring, measurement, review and reporting has been established.

Every monitoring measure device in the system, including the project activity meters, is calibrated every year or every two years by independent and accredited third parties. The calibration procedure consists in comparing the measuring system with a higher precision reference meter.

No specific procedures beyond the already established QA/QC procedures will be necessary. The established procedures reflect good monitoring and reporting practices.

### 3.6 Calculation of GHG Emissions

The methodologies for calculating emission reductions are transparently documented and comply with existing good practice.

According to AM0026, no sources of leakage were identified.



Since the project consists of a run-of-river power plant without a reservoir, project emissions are considered zero for this project.

The baseline emission factor for the project is determined *ex-post* as a combined margin, consisting of combination of the operating margin (OM) and build margin (BM). AM0026 version 2 calculates the operating margin by observing actual dispatch data, the generation from the power plants and the merit order. The emission factor for the operating margin is determined by the generation that would be dispatched in the absence of this CDM Project.

The BM emission factor will be determined as option (i) in AM0026, i.e., following the BM emission factor estimation process described in ACM0002 version 6 Option 2, which is calculated on an *ex-post* basis as the generation-weighted average emission factor (tCO<sub>2</sub>/MWh) of the most recent 20% capacity added to the SIC.

The weights  $\omega_{OM}$  and  $\omega_{BM}$  are selected as 0.50 and 0.50 respectively.

The project uses an estimate of the operating margin of 0.517 tCO<sub>2</sub>/MWh and an estimate of the build margin of 0.298 t CO<sub>2</sub>/MWh. This gives a projected combined margin of 0.408 tCO<sub>2</sub>/MWh. The project is estimated to deliver approximately 422 GWh per year. Hence, estimated GHG emission reductions from the project are 1 205 232 tonnes CO<sub>2</sub> equivalent (tCO<sub>2</sub>e) during the 7 year crediting period starting on 01 July 2008. This results in estimated average annual emissions reductions of 172 176 tCO<sub>2</sub>e. The exact amount will be calculated *ex-post* from the actual electricity generation by the project and the dispatch data analysis obtained for the particular year.

### 3.7 Environmental Impacts

It has been verified that the Chilean authority deems the Environmental Impact of the project insignificant. In October 2000, the project completed an Environmental Impact Assessment. The report recommends a number of measures to mitigate environmental impacts during the construction and implementation phases. These measures have been addressed adequately. The EIA was approved on 26 December 2000 /13/

### 3.8 Comments by Local Stakeholders

Different stakeholders from local governmental officials, local residents and related employees were consulted during the stakeholder consultation process. The Environmental Impact Assessment was distributed to 11 local authorities. The EIA also included a public consultation period of 60 days, which was conducted through announcements in local newspapers and workshops attended by representatives of the local community of Quilleco.

Comments received by local authorities and the community relate to the following aspects: Increased erosion deterioration of the landscape, air emissions, noise generation during construction, loss of vegetation and biodiversity due to project operation, loss of agricultural area, lack of water for biological functions in the river, extinction of fish species in Laja river, employment generation and archaeological site founding. Comments, observations and questions received from above mentioned authorities and local communities were answered by Colbún S.A during the EIA process /13/.



#### **4 COMMENTS BY PARTIES, STAKEHOLDERS AND NGOS**

The PDD\* of 31 March 2007 was made publicly available on DNV's climate change website ([www.dnv.com/certification/climatechange](http://www.dnv.com/certification/climatechange)) and Parties, stakeholders and NGOs were through the CDM website invited to provide comments during a 30 days period from 6 May 2007 to 4 June 2007. No comments were received.

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\* This PDD indicated that the name of the project activity is "Quilleco 70 MW Run-of-River Hydropower Project"





## 5 VALIDATION OPINION

*Det Norske Veritas Certification AS (DNV) has performed a validation of the “Chile: Quilleco Hydroelectric Project” in Chile. The validation was performed on the basis of UNFCCC criteria for the Clean Development Mechanism and host country criteria, as well as criteria given to provide for consistent project operations, monitoring and reporting.*

*The review of the project design documentation and the subsequent follow-up interviews have provided DNV with sufficient evidence to determine the fulfilment of stated criteria.*

*The project participants are Hidroelectrica Guardia Vieja AS, the International Bank for Reconstruction and Development and the Netherlands. The host Party Chile and the Annex I Party the Netherlands meet all relevant participation requirements and have provided written approval of voluntary participation in the project. The DNA from Chile confirmed that the project assists in achieving sustainable development.*

*The project consists of a run-of-river power plant with 70 MW capacity that utilizes the water discharged by the Rucúe hydropower plant. The project will generate approximately 422 GWh per year and will dispatch 47 MW of base power to the SIC electric grid.*

*The project correctly applies AM0026 (Version 2 of 19 May 2006) - “Methodology for zero-emissions grid-connected electricity generation from renewable sources in Chile or in countries with merit order based dispatch grid”.*

*By generating renewable energy which will displace fossil fuel based grid electricity, the project results in reductions of CO<sub>2</sub> emissions that are real, measurable and give long-term benefits to the mitigation of climate change. It is demonstrated that the project is not a likely baseline scenario. Emission reductions attributable to the project are hence additional to any that would occur in the absence of the project activity.*

*The total emission reductions from the project are estimated to be on the average 172 176 tCO<sub>2</sub>e over the selected 7 year crediting period. The emission reduction forecast has been checked and is deemed likely that the state amount is achieved given that the underlying assumptions do not change.*

*The monitoring methodology AM0026 has been correctly applied. The monitoring plan sufficiently specifies the monitoring requirements. Adequate monitoring procedures have been implemented.*

*Local stakeholders were invited initially through public discussion during the EIA process.*

*In summary, it is DNV’s opinion that the “Chile: Quilleco Hydroelectric Project”, as described in the revised and submitted project design document version 2.1 of 27 June 2008 meets all relevant UNFCCC requirements for the CDM and all relevant host country criteria and correctly applies the baseline and monitoring methodology AM0026 (Version 2 of 19 May 2006). Hence, DNV requests the registration of the “Chile: Quilleco Hydroelectric Project” as a CDM project activity.*



## REFERENCES

*Documents provided by the project proponent that relate directly to the project:*

- /1/ International Bank for Reconstruction and Development: Project Design Document for the Quilleco 70 MW Run-of-River Hydropower Project, Version 1 of 31 March 2007.
- /2/ International Bank for Reconstruction and Development: Project Design Document for the Chile: Quilleco Hydroelectric Project Version 1.2 of 31 July 2007.
- /3/ International Bank for Reconstruction and Development: Project Design Document for the Chile: Quilleco Hydroelectric Project Version 1.3 of 26 August 2007.
- /4/ International Bank for Reconstruction and Development: Project Design Document for the Chile: Quilleco Hydroelectric Project Version 1.4 of 29 August 2007.
- /5/ International Bank for Reconstruction and Development: Project Design Document for the Chile: Quilleco Hydroelectric Project Version 1.5 of 4 September 2007.
- /6/ International Bank for Reconstruction and Development: Project Design Document for the Chile: Quilleco Hydroelectric Project Version 1.7 of 11 October 2007.
- /7/ International Bank for Reconstruction and Development: Project Design Document for the Chile: Quilleco Hydroelectric Project Version 2.1 of 27 June 2008.
- /8/ International Bank for Reconstruction and Development: Spreadsheets for emission reduction calculation – 20 June 2007.
- /9/ International Bank for Reconstruction and Development: Spreadsheets for add-investment analysis – 20 June 2007.
- /10/ Colbun S.A.: Feasibility Study of April 1998.
- /11/ Colbun S.A.: Board meeting of 26 October 2004 evidencing project approval and that CDM was considered before project implementation and construction.
- /12/ CDEC-SIC: Node Prices Report
- /13/ Resolution CONAMA 338, from 26 December 2000, approving the EIA.
- /14/ Letter of Approval issued by Chile DNA on 31 August 2005.
- /15/ Letter of Approval issued by the Netherlands DNA on 13 January 2006.
- /16/ Project PIN submitted to IBRD
- /17/ Letter of Intent with IBRD with regard to the purchase and sale of emission reductions that were to aid the project finance dated 22 September 2004
- /18/ Contract with Züblin International GmbH Chile Ltd. for tunnel civil works signed on 15 November 2004
- /19/ Contract with Power Machines – ZTL, LMZ, Elektrosila, Emergomaschexport for electro-mechanical equipment supply and assemble signed on 1 March 2005.





*Background documents related to the design and/or methodologies employed in the design or other reference documents:*

- /16/ International Emission Trading Association (IETA) & the World Bank's Prototype Carbon Fund (PCF), Validation and Verification Manual. <http://www.vvmanual.info>
- /17/ CDM-EB: AM0026 – “Methodology for zero-emissions grid-connected electricity generation from renewable sources in Chile or in countries with merit order based dispatch grid”. Version 2 of 19 May 2006.
- /18/ CDM-EB: Approved Consolidated Baseline and Monitoring Methodology ACM0002 - “Consolidated baseline methodology for grid-connected electricity generation from renewable sources”, version 6 of 19 May 2006
- /19/ CDM Executive Board: Tool for the demonstration and assessment of additionality. Version 3 of 16 February 2007.

*Persons interviewed during the validation, or persons who contributed with other information that are not included in the documents listed above:*

- /20/ IBRD: Pedro Huarte-Mendicoa
- /21/ IBRD: Jose-Manuel Contardo

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## **APPENDIX A**

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### **CDM VALIDATION PROTOCOL**

**Table 1 Mandatory Requirements for Clean Development Mechanism (CDM) Project Activities**

Requirement	Reference	Conclusion	Cross Reference / Comment
1. The project shall assist Parties included in Annex I in achieving compliance with part of their emission reduction commitment under Art. 3	Kyoto Protocol Art.12.2	OK	Table 2, Section E.4.1
2. The project shall assist non-Annex I Parties in achieving sustainable development and shall have obtained confirmation by the host country thereof	Kyoto Protocol Art. 12.2, CDM Modalities and Procedures §40a	OK	Table 2, Section E.4.1 Letter of Approval of Chilean's Environmental National Commission of 31 August 2005.
3. The project shall assist non-Annex I Parties in contributing to the ultimate objective of the UNFCCC	Kyoto Protocol Art.12.2.	OK	Table 2, Section E.4.1
4. The project shall have the written approval of voluntary participation from the designated national authority of each party involved	Kyoto Protocol Art. 12.5a, CDM Modalities and Procedures §40a	OK	Chile: Letter of Approval of 31 August 2005 The Netherlands: Letter of Approval of 13 January 2006.
5. The emission reductions shall be real, measurable and give long-term benefits related to the mitigation of climate change	Kyoto Protocol Art. 12.5b	OK	Table 2, Section E
6. Reduction in GHG emissions shall be additional to any that would occur in absence of the project activity, i.e. a CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity	Kyoto Protocol Art. 12.5c, CDM Modalities and Procedures §43	OK	Table 2, Section B.2
7. In case public funding from Parties included in Annex I is used for the project activity, these Parties shall provide an affirmation that such funding does not result in a diversion of official development assistance and is separate from and is not counted towards the financial obligations of these Parties	Decision 17/CP.7, CDM Modalities and Procedures Appendix B, § 2	<del>CL-13</del> OK	The Netherlands have confirmed that the public funding involved in the NCDMF does not result in a diversion of official development assistance and is separate from and is not counted towards the financial

Requirement	Reference	Conclusion	Cross Reference / Comment
			obligations of the Netherlands.
8. Parties participating in the CDM shall designate a national authority for the CDM	CDM Modalities and Procedures §29	OK	CONAMA is the DNA of Chile and the Ministry of Housing, Spatial Planning and the Environment is the DNA of the Netherlands.
9. The host Party and the participating Annex I Party shall be a Party to the Kyoto Protocol	CDM Modalities §30/31a	OK	Chile has ratified the Kyoto protocol on 26 August 2002. The Netherlands ratified the Protocol on 31 May 2004.
10. The participating Annex I Party's assigned amount shall have been calculated and recorded	CDM Modalities and Procedures §31b	OK	The Netherlands' assigned amount is 92% of the 1990 emissions level.
11. The participating Annex I Party shall have in place a national system for estimating GHG emissions and a national registry in accordance with Kyoto Protocol Article 5 and 7	CDM Modalities and Procedures §31b	OK	
12. Comments by local stakeholders shall be invited, a summary of these provided and how due account was taken of any comments received	CDM Modalities and Procedures §37b	OK	Table 2, Section G
13. Documentation on the analysis of the environmental impacts of the project activity, including transboundary impacts, shall be submitted, and, if those impacts are considered significant by the project participants or the Host Party, an environmental impact assessment in accordance with procedures as required by the Host Party shall be carried out.	CDM Modalities and Procedures §37c	OK	Table 2, Section F
14. Baseline and monitoring methodology shall be previously approved by the CDM Executive Board	CDM Modalities and Procedures §37e	OK	Table 2, Section B.1.1 and D.1.1
15. Provisions for monitoring, verification and reporting shall be in accordance with the modalities described in the Marrakech Accords and relevant decisions of the COP/MOP	CDM Modalities and Procedures §37f	OK	Table 2, Section D

Requirement	Reference	Conclusion	Cross Reference / Comment
16. Parties, stakeholders and UNFCCC accredited NGOs shall have been invited to comment on the validation requirements for minimum 30 days, and the project design document and comments have been made publicly available	CDM Modalities and Procedures §40	OK	The PDD of 31 March 2007 was made publicly available on DNV's climate change website ( <a href="http://www.dnv.com/certification/climatechange">www.dnv.com/certification/climatechange</a> ) and Parties, stakeholders and NGOs were through the CDM website invited to provide comments during a 30 days period from 6 May 2007 to 4 June 2007. No comments were received.
17. A baseline shall be established on a project-specific basis, in a transparent manner and taking into account relevant national and/or sectoral policies and circumstances	CDM Modalities and Procedures §45c,d	OK	Table 2, Section B.2
18. The baseline methodology shall exclude to earn CERs for decreases in activity levels outside the project activity or due to force majeure	CDM Modalities and Procedures §47	OK	Table 2, Section B.2
19. The project design document shall be in conformance with the UNFCCC CDM-PDD format	CDM Modalities and Procedures Appendix B, EB Decision	GL-8 GL-9 GL-4 OK	.

**Table 2 Requirements Checklist**

Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
<b>A. General Description of Project Activity</b> <i>The project design is assessed.</i>					
<b>A.1. Project Boundaries</b> <i>Project Boundaries are the limits and borders defining the GHG emission reduction project.</i>					
A.1.1. Are the project's spatial (geographical) boundaries clearly defined?	/7/	DR	Yes, Quilleco is located in the 8th region of Bío-Bío of Chile, at about 35 km east from Los Angeles city and 500 km south from Santiago.		OK
A.1.2. Are the project's system (components and facilities used to mitigate GHGs) boundaries clearly defined?	/7/	DR	The projects system boundary is the hydropower plant itself along with the canals and tunnels leading up to the plant and the Chilean SIC.		OK
<b>A.2. Technology to be employed</b> <i>Validation of project technology focuses on the project engineering, choice of technology and competence/maintenance needs. The validator should ensure that environmentally safe and sound technology and know-how is used.</i>					
A.2.1. Does the project design engineering reflect current good practices?	/7/	DR	Yes, the technology employed by the project is currently employed worldwide for run-of-the-river hydropower projects. The project design reflects state of the art technology detailing the project scheme and project details such as type of turbine (Francis) and other physical infrastructure. Technologies defined are state of the art for	GL-14	OK

\* MoV = Means of Verification, DR= Document Review, I= Interview

Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
			<p>run-of-the-river generating stations.</p> <p>Relevant documents related to project design have not been provided to DNV. The following documents is therefore requested:</p> <ul style="list-style-type: none"> <li>- copy of the Feasibility Study, in particular the part that presents the estimation of plant capacity, plant generation per year and power dispatched to the grid</li> <li>- picture of the generator and the turbine plates with the technical characteristics</li> </ul> <p>registration of the plant in the National Electricity Agency</p>		
A.2.2. Is the project technology likely to be substituted by other or more efficient technologies within the project period?	/7/	DR	No.		OK
A.2.3. Does the project require extensive initial training and maintenance efforts in order to work as presumed during the project period?	/7/	DR	Yes. Colbun S.A. will ensure that the required capacity and internal training is made available to its operational staff to enable them to undertake all the required tasks in a transparent manner.		OK
A.2.4. Does the project make provisions for meeting training and maintenance needs?	/7/	DR	See A.2.3		OK
<b>A.3. Contribution to Sustainable Development</b> <i>The project's contribution to sustainable development is assessed.</i>					
A.3.1. Is the project in line with relevant legislation and plans in the host country?	/7/	DR	Yes, the project is in line with the legislations applicable to a run-of-river hydropower project in Chile.		OK

\* MoV = Means of Verification, DR= Document Review, I= Interview

Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
A.3.2. Is the project in line with host-country specific CDM requirements?	/7/	DR	Yes, the project is in line with the CDM requirements of Chile.		OK
A.3.3. Is the project in line with sustainable development policies of the host country?	/7/	DR	The project's sustainable development indicators i.e. clean energy, reforestation, job creation and economic activity during construction seems reasonable. These indicators can thus be said to be in line with national priorities. No evidences of the Environment Impact Assessment and environmental licenses were provided.	GL-10	OK
A.3.4. Will the project create other environmental or social benefits than GHG emission reductions?	/7/	DR	The project will give increased opportunities for employment in the region.		OK
<b>B. Project Baseline</b> <i>The validation of the project baseline establishes whether the selected baseline methodology is appropriate and whether the selected baseline represents a likely baseline scenario.</i>					
<b>B.1. Baseline Methodology</b> <i>It is assessed whether the project applies an appropriate baseline methodology.</i>					
B.1.1. Is the baseline methodology previously approved by the CDM Executive Board?	/7/	DR	The project applies the approved baseline methodology AM0026 "Methodology for zero-emissions grid-connected electricity generation from renewable sources in Chile or in countries with merit order based dispatch grid".		OK
B.1.2. Is the baseline methodology the one deemed most applicable for this project and is the appropriateness justified?	/7/	DR	The baseline methodology is applicable to the proposed project activity as the electricity capacity additions are a run-of-		OK

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Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
			river hydro power plant and the project is connected to the interconnected grids of the Republic of Chile.		
<b>B.2. Baseline Determination</b> <i>The choice of baseline will be validated with focus on whether the baseline is a likely scenario, whether the project itself is not a likely baseline scenario, and whether the baseline is complete and transparent.</i>					
B.2.1. Is the application of the methodology and the discussion and determination of the chosen baseline transparent?	/7/	DR	Yes.		OK
B.2.2. Has the baseline been determined using conservative assumptions where possible?	/7/	DR	The combined margin emission factor has been calculated as a weighted average of OM and BM. Both of these will be measured ex-post from official data supplied by the Economic Dispatch Centre (CDEC-SIC).		OK
B.2.3. Has the baseline been established on a project-specific basis?	/7/	DR	The baseline has been developed taking into account this particular project and the Chilean SIC.		OK
B.2.4. Does the baseline scenario sufficiently take into account relevant national and/or sectoral policies, macro-economic trends and political aspirations?	/7/	DR	Yes.		OK
B.2.5. Is the baseline determination compatible with the available data?	/7/	DR	Yes. The baseline is determined using dispatch data analysis. Data required for this is compiled and made available for the public by the CDEC-SIC.		OK
B.2.6. Does the selected baseline represent the most likely scenario among other possible and/or discussed scenarios?	/7/	DR	The selected baseline is determined by using an optimization model which is based on successive iterations of comparing different options of system expansion that		OK

\* MoV = Means of Verification, DR= Document Review, I= Interview

Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
			minimizes the total cost. Hence, it is seemingly the most likely scenario.		
B.2.7. Is it demonstrated/justified that the project activity itself is not a likely baseline scenario?	/7/	DR	<p>As required by AM0026, the four steps of the “Tool for demonstration and assessment of additionality” version 3 have been applied to demonstrate the additionality of the project:</p> <p>The applied tool “Tool for the demonstration and assessment of additionality” has not been referenced in section B.1 of the PDD.</p> <p>Step 1: The identification of alternatives to the project activity is based on the Chilean national authority indicative expansion plan; according to this plan, the least cost alternative for the expansion of the SIC are combined cycle natural gas fired power plants and hydro dam. The rest of the projects are renewable energy CDM projects. This model demonstrates that the Quilleco Hydroelectric Project is not the only alternative for the expansion of the system and nor the least cost alternative, which are combined cycle natural gas fired power plants and hydro dams (non run-of-river).</p> <p>Step 2: A cost analysis model is run once with the baseline situation predicted by the expansion plan and once including the project situation. According to AM 0026, the proposed CDM project activity is additional only if the net present cost of the energy supply estimate considering the project</p>	<del>CL-2</del> <del>CL-3</del> <del>CL-4</del>	OK

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Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
			<p>situation is greater than that estimated considering the baseline situation. The comparison of both scenarios shows that the project would be additional. The CDM was seriously considered before the approval of the project and the expected revenues from the CDM component of the project and the Netherlands Clean Development Mechanism Facility (NCDMF) as buyer were crucial for the investment decision.</p> <p>DNV requests the spreadsheets with the expansion model test and net present value calculations that support the additionality discussion of the project.</p> <p>DNV requests evidence that CDM was considered before project approval, and that it was a prerequisite for the investment.</p> <p>Step 3: Not selected.</p> <p>Step 4: Run of the river hydro plants are not a common practice in Chile. It is confirmed that prior to Quilleco only a few run-of-river hydro plants were developed in the SIC. The Chacabuquito hydro project was built in 2001 and is a CDM project.</p> <p>The analysis demonstrates it is deemed appropriate to consider the project additional.</p>		
B.2.8. Have the major risks to the baseline been identified?	/7/	DR	Since the emission reductions from the project will be measured ex-post, there are no risks to the baseline.		OK

\* MoV = Means of Verification, DR= Document Review, I= Interview

Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
B.2.9. Is all literature and sources clearly referenced?	/7/	DR	Yes.		OK
<b>C. Duration of the Project/ Crediting Period</b> <i>It is assessed whether the temporary boundaries of the project are clearly defined.</i>					
C.1.1. Are the project's starting date and operational lifetime clearly defined and reasonable?	/7/	DR	Yes, the starting date of the project is 26 October 2004 and it has a lifetime of 30 years. The starting date of a project activity is the earliest of implementation, construction and real action. Evidence for this is requested.	GL-15	OK
C.1.2. Is the assumed crediting time clearly defined (renewable crediting period of seven years with two possible renewals or fixed crediting period of 10 years with no renewal)?	/7/	DR	Yes, the project adopts a renewable crediting period of 7 years with two possible renewals starting from 01 July 2008.	GL-7	OK
<b>D. Monitoring Plan</b> <i>The monitoring plan review aims to establish whether all relevant project aspects deemed necessary to monitor and report reliable emission reductions are properly addressed ((Blue text contains requirements to be assessed for optional review of monitoring methodology prior to submission and approval by CDM EB).</i>					
<b>D.1. Monitoring Methodology</b> <i>It is assessed whether the project applies an appropriate baseline methodology.</i>					
D.1.1. Is the monitoring methodology previously approved by the CDM Executive Board?	/7/	DR	Yes. The project uses the approved monitoring methodology AM0026 "Monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources in Chile or in countries		OK

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Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
			with merit order based dispatch grid”.		
D.1.2. Is the monitoring methodology applicable for this project and is the appropriateness justified?	/7/	DR	Yes.		OK
D.1.3. Does the monitoring methodology reflect good monitoring and reporting practices?	/7/	DR	Yes, the monitoring methodology is suitable for the dispatch data analysis method for calculating the OM. The electricity actually dispatched to the grid will be monitored and the emission factors for the marginal plants will be collated from the SIC.		OK
D.1.4. Is the discussion and selection of the monitoring methodology transparent?	/7/	DR	Yes.		OK
<b>D.2. Monitoring of Project Emissions</b> <i>It is established whether the monitoring plan provides for reliable and complete project emission data over time.</i>					
D.2.1. Does the monitoring plan provide for the collection and archiving of all relevant data necessary for estimation or measuring the greenhouse gas emissions within the project boundary during the crediting period?	/7/	DR	Since the project is a run-of-the-river hydroelectric project there are no emissions from the project itself.		OK
D.2.2. Are the choices of project GHG indicators reasonable?	/7/	DR	See D.2.1.		OK
D.2.3. Will it be possible to monitor / measure the specified project GHG indicators?	/7/	DR	See D.2.1.		OK
D.2.4. Will the indicators give opportunity for real measurements of project emissions?	/7/	DR	See D.2.1.		OK
D.2.5. Will the indicators enable comparison of project data and performance over time?	/7/	DR	See D.2.1.		OK

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Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
<b>D.3. Monitoring of Leakage</b> <i>It is assessed whether the monitoring plan provides for reliable and complete leakage data over time.</i>					
D.3.1. Does the monitoring plan provide for the collection and archiving of all relevant data necessary for determining leakage?	/7/	DR	According to the methodology there are no leakages for this project.		OK
D.3.2. Are the choices of leakage indicators reasonable?	/7/	DR	See D.3.1.		OK
D.3.3. Will it be possible to monitor / measure the specified leakage indicators?	/7/	DR	See D.3.1.		OK
D.3.4. Will the indicators give opportunity for real measurements of leakage effects?	/7/	DR	See D.3.1.		OK
<b>D.4. Monitoring of Baseline Emissions</b> <i>It is established whether the monitoring plan provides for reliable and complete project emission data over time.</i>					
D.4.1. Does the monitoring plan provide for the collection and archiving of all relevant data necessary for determining baseline emissions during the crediting period?	/7/	DR	Yes, the monitoring plan provides for the collection and archiving of all data relevant for calculating the emission reductions.		OK
D.4.2. Is the choice of baseline indicators, in particular for baseline emissions, reasonable?	/7/	DR	The OM and BM for the baseline will be measured ex-post based on actual data from CDEC-SIC. Data regarding the marginal plants is also publicly available official data. Hence the choice of these baseline indicators is deemed reasonable.		OK
D.4.3. Will it be possible to monitor / measure the specified baseline indicators?	/7/	DR	Yes.		OK
D.4.4. Will the indicators give opportunity for real measurements of baseline emissions?			Yes.		OK

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Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
<b>D.5. Monitoring of Sustainable Development Indicators/ Environmental Impacts</b> <i>It is checked that choices of indicators are reasonable and complete to monitor sustainable performance over time.</i>					
D.5.1. Does the monitoring plan provide the collection and archiving of relevant data concerning environmental, social and economic impacts?	/7/	DR	The monitoring plan provides for the collection and archiving of data required to monitor sustainable development parameters.		OK
D.5.2. Is the choice of indicators for sustainability development (social, environmental, economic) reasonable?	/7/	DR	The project provides for monitoring of reforestation, water flow and quality, job creation and increase of economic activities. Taking the context of the project, these indicators are deemed sufficient.		OK
D.5.3. Will it be possible to monitor the specified sustainable development indicators?	/7/	DR	Yes, the project has sorted out detailed procedures for monitoring the sustainable development parameters.		OK
D.5.4. Are the sustainable development indicators in line with stated national priorities in the Host Country?	/7/	DR	Yes		OK
<b>D.6. Project Management Planning</b> <i>It is checked that project implementation is properly prepared for and that critical arrangements are addressed.</i>					
D.6.1. Is the authority and responsibility of project management clearly described?	/7/	DR	Yes.		OK
D.6.2. Is the authority and responsibility for registration, monitoring, measurement and reporting clearly described?	/7/	DR	Yes.		OK
D.6.3. Are procedures identified for training of	/7/	DR	Yes.		OK

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Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
monitoring personnel?					
D.6.4. Are procedures identified for emergency preparedness for cases where emergencies can cause unintended emissions?	/7/	DR	There are no unintended emergency emissions for the project.		OK
D.6.5. Are procedures identified for calibration of monitoring equipment?	/7/	DR	Yes.		OK
D.6.6. Are procedures identified for maintenance of monitoring equipment and installations?	/7/	DR	Yes.		OK
D.6.7. Are procedures identified for monitoring, measurements and reporting?	/7/	DR	Yes.		OK
D.6.8. Are procedures identified for day-to-day records handling (including what records to keep, storage area of records and how to process performance documentation)	/7/	DR	Yes. Some data variables have to be archived for a period of 2 years from the end of the crediting period (up to 21 years). This should be reflected in the PDD.	CL-6	OK
D.6.9. Are procedures identified for dealing with possible monitoring data adjustments and uncertainties?	/7/	DR	Yes.		OK
D.6.10. Are procedures identified for review of reported results/data?	/7/	DR	Yes.		OK
D.6.11. Are procedures identified for internal audits of GHG project compliance with operational requirements where applicable?	/7/	DR	Yes.		OK
D.6.12. Are procedures identified for project performance reviews before data is submitted for verification, internally or externally?	/7/	DR	Yes.		OK
D.6.13. Are procedures identified for corrective actions in order to provide for more accurate future monitoring and reporting?	/7/	DR	Yes.		OK

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Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
<b>E. Calculation of GHG Emissions by Source</b> <i>It is assessed whether all material GHG emission sources are addressed and how sensitivities and data uncertainties have been addressed to arrive at conservative estimates of projected emission reductions.</i>					
<b>E.1. Predicted Project GHG Emissions</b> <i>The validation of predicted project GHG emissions focuses on transparency and completeness of calculations.</i>					
E.1.1. Are all aspects related to direct and indirect GHG emissions captured in the project design?	/7/	DR	There are no emissions from the project operation since it is a run-of-the- river hydroelectric project.		OK
E.1.2. Are the GHG calculations documented in a complete and transparent manner?	/7/	DR	See E.1.1.		OK
E.1.3. Have conservative assumptions been used to calculate project GHG emissions?	/7/	DR	See E.1.1.		OK
E.1.4. Are uncertainties in the GHG emissions estimates properly addressed in the documentation?	/7/	DR	See E.1.1.		OK
E.1.5. Have all relevant greenhouse gases and source categories listed in Kyoto Protocol Annex A been evaluated?	/7/	DR	See E.1.1.		OK
<b>E.2. Leakage</b> <i>It is assessed whether there leakage effects, i.e. change of emissions which occurs outside the project boundary and which are measurable and attributable to the project, have been properly assessed.</i>					
E.2.1. Are potential leakage effects beyond the chosen	/7/	DR	There are no leakages from the project.		OK

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Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
project boundaries properly identified?					
E.2.2. Have these leakage effects been properly accounted for in calculations?	/7/	DR	See E.1.1		OK
E.2.3. Does the methodology for calculating leakage comply with existing good practice?	/7/	DR	See E.1.1		OK
E.2.4. Are the calculations documented in a complete and transparent manner?	/7/	DR	See E.1.1		OK
E.2.5. Have conservative assumptions been used when calculating leakage?	/7/	DR	See E.1.1		OK
E.2.6. Are uncertainties in the leakage estimates properly addressed?	/7/	DR	See E.1.1		OK
<b>E.3. Baseline Emissions</b> <i>The validation of predicted baseline GHG emissions focuses on transparency and completeness of calculations.</i>					
E.3.1. Have the most relevant and likely operational characteristics and baseline indicators been chosen as reference for baseline emissions?	/7/	DR	Yes.		OK
E.3.2. Are the baseline boundaries clearly defined and do they sufficiently cover sources and sinks for baseline emissions?	/7/	DR	Yes. The baseline boundary is the Chilean SIC.		OK
E.3.3. Are the GHG calculations documented in a complete and transparent manner?	/7/	DR	Yes, the GHG calculations have been documented in a transparent manner.		OK
E.3.4. Have conservative assumptions been used when calculating baseline emissions?	/7/	DR	The baseline emissions will be calculated ex-post using the despatch data analysis.		OK
E.3.5. Are uncertainties in the GHG emission estimates properly addressed in the documentation?	/7/	DR	Since the emissions will be measured ex-post there are no uncertainties in the baseline emissions.		OK
E.3.6. Have the project baseline(s) and the project emissions been determined using the same	/7/	DR	The project baseline has been determined using the same methodology. There are no		OK

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Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
appropriate methodology and conservative assumptions?			project emissions.		
<b>E.4.Emission Reductions</b> Validation of baseline GHG emissions will focus on methodology transparency and completeness in emission estimations.					
E.4.1. Will the project result in fewer GHG emissions than the baseline scenario?	/7/	DR	The project is forecasted to reduce CO <sub>2</sub> emissions to the extent of 1 205 232 tCO <sub>2</sub> e (172 176 tCO <sub>2</sub> e / year average) over the defined first renewable 7 years crediting period.		OK
<b>F. Environmental Impacts</b> <i>Documentation on the analysis of the environmental impacts will be assessed, and if deemed significant, an EIA should be provided to the validator.</i>					
F.1.1. Has an analysis of the environmental impacts of the project activity been sufficiently described?	/7/	DR	Yes, the project has accounted for minimum ecological flows, reforestation plans and environmental management during construction.		OK
F.1.2. Are there any Host Party requirements for an Environmental Impact Assessment (EIA), and if yes, is an EIA approved?	/7/	DR	The project completed an Environmental Impact Statement in October 2000. No evidences of the Environment Impact Assessment and environmental licenses were provided.	GL-40	OK
F.1.3. Will the project create any adverse environmental effects?	/7/	DR	According to the PDD, the Environmental Impact Assessment recommends a number of measures to mitigate environmental impacts during the construction and		OK

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Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
			implementation phases. These measures have been addressed adequately.		
F.1.4. Are transboundary environmental impacts considered in the analysis?	/7/	DR	None anticipated.		OK
F.1.5. Have identified environmental impacts been addressed in the project design?	/7/	DR	Yes. This is considered in the project EIA.		OK
F.1.6. Does the project comply with environmental legislation in the host country?	/7/	DR	See F.1.2	GL 10	OK
<b>G. Stakeholder Comments</b> <i>The validator should ensure that a stakeholder comments have been invited and that due account has been taken of any comments received.</i>					
G.1.1. Have relevant stakeholders been consulted?	/7/	DR	Different stakeholders from local governmental officials, local residents and related employees were consulted during the stakeholder consultation process and onsite survey was conducted with the local community.		OK
G.1.2. Have appropriate media been used to invite comments by local stakeholders?	/7/	DR	See G.1.1		OK
G.1.3. If a stakeholder consultation process is required by regulations/laws in the host country, has the stakeholder consultation process been carried out in accordance with such regulations/laws?	/7/	DR	See G.1.1		OK
G.1.4. Is a summary of the stakeholder comments received provided?	/7/	DR	The PDD states that comments received by local authorities and the community relate to the following aspects: Increased erosion deterioration of the landscape, air emissions, noise generation during construction, loss of vegetation and biodiversity due to project operation, loss of	GL 11	OK

\* MoV = Means of Verification, DR= Document Review, I= Interview

Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
			agricultural area, lack of water for biological functions in the river, extinction of fish species in Laja river, employment generation and archaeological site founding. DNV requests evidence of the stakeholder's invitation for comments, the comments received and the answers provided by the project proponent.		
G.1.5. Has due account been taken of any stakeholder comments received?	/7/	DR	Comments, observations and questions received from above mentioned authorities and local communities were answered by Colbún S.A during the EIA process. DNV requests evidence of the stakeholder's invitation for comments, the comments received and the answers provided by the project proponent.	GL-14	OK

\* MoV = Means of Verification, DR= Document Review, I= Interview

**Table 3 Resolution of Corrective Action and Clarification Requests**

<b>Draft report corrective action requests and requests for clarifications</b>	<b>Ref. to Table 2</b>	<b>Summary of project participants' response</b>	<b>Final conclusion</b>
<b>CL 1</b> The CDM-PDD template has been updated and the PDD has to updated accordingly.		Project's PDD has been updated to correct deviations in the cover pages and tables A.3, A.4.4 and B.6.4	The revised PDD was corrected according to the current CDM-PDD format. Therefore this CL is closed.
<b>CL 2</b> The applied tool "Tool for the demonstration and assessment of additionality" has not been referenced in section B.1 of the PDD.	B.2.7	The PDD has been updated and now includes the recommended reference to the additionality tool (see page 8)	The revised PDD correctly addresses the additionality tool. Therefore this CL is closed.
<b>CL 3</b> DNV requests the spreadsheets with the expansion model test and net present value calculations that support the additionality discussion of the project.	B.2.7	The worksheets of the expansion model test and net present value has been submitted in separated files (see attached file CL03 - Quilleco add-investment analysis.xls)	Clarifications were provided and found satisfactory. The net present value calculations were presented as an evidence of the utilization of the expansion model's results described. Therefore this CL is closed.
<b>CL 4</b> DNV requests evidence that CDM was considered before project approval, and that it was a prerequisite for the investment.	B.2.7	Copy of Colbun board meeting has been submitted (See attached file CL04 - COBUN Board meeting and Quilleco approval.pdf)	Evidences were provided to DNV's satisfaction. Therefore this CL is closed.
<b>CL 5</b> The calculations of the operation margin and build margin emission factors have not been provided for the assessment by DNV. The spreadsheets are requested..		Detail spreadsheet have been submitted with both, the Build Margin and Operating Margin estimations (see attached file CL05 - am026_estimated_data.zip)	The spreadsheet was presented and found satisfactory. Therefore this CL is closed.
<b>CL 6</b> Some data variables have to be archived for a period of 2 years from the end of the crediting period (up to 21 years). This should be reflected in the PDD.	D.6.8	In the updated PDD, an additional paragraph has been included on section B.7.2 (page 31), requiring to archive for a period of 2 years from the end of the crediting period (21 years)	OK. CL is closed.
<b>CL 7</b>	C.1.2	The new starting date of crediting	OK. CL is closed.

Draft report corrective action requests and requests for clarifications	Ref. to Table 2	Summary of project participants' response	Final conclusion
It is requested that the crediting period starts later than the realistic date of CDM registration.		period has been updated in the PDD to 01/11/2007.	
<b>CL 8</b> According to the guideline for completing the Project Design Document (CDM- PDD), dates should be described in the DD/MM/YYYY format.		All date formats have been updated accordingly in the updated PDD	OK. CL is closed.
<b>CL 9</b> The PDD has to be presented in English. The Spanish parts of the PDD is requested to be removed/translated.		Spanish language has been removed/translated.	OK. CL is closed.
<b>CL 10</b> No evidences of the Environment Impact Assessment and environmental licenses were provided.	A.3.3 F.1.2 F.1.6	A copy of the Environmental Impact Assessment and Environmental licenses has been provided (see attached file CL11 - Quilleco RCA.zip)	Evidences were provided to DNV's satisfaction. Therefore this CL is closed.
<b>CL 11</b> DNV requests evidence of the stakeholder's invitation for comments, the comments received and the answers provided by the project proponent.	G.1.4 G.1.5	A copy of the Environmental Impact Assessment and Environmental licenses has been provided. The EIA describes stakeholders invitation for comments and the comments received and the project proponent answers to them. (see attached file CL11 - Quilleco RCA.zip)	Evidences were provided to DNV's satisfaction. Therefore this CL is closed.
<b>CL 12</b> Please confirm whether The Netherlands will be a project participant and will receive part of the credits.		Yes, the Netherlands will be a Project Participant and will receive part of the credits.	OK. CL is closed.
<b>CL 13</b> Please confirm whether the fund used to financing is not diversion of ODA funding towards Chile.		No diversion of ODA funding towards Chile is available. This has been indicated in the PDD (see section A.4.5 and Annex 2)	OK. The Netherlands have confirmed that the public funding involved in the NCDMF does not result in a diversion of official development assistance and

Draft report corrective action requests and requests for clarifications	Ref. to Table 2	Summary of project participants' response	Final conclusion
			is separate from and is not counted towards the financial obligations of the Netherlands. CL is closed.
<p><b>CL 14</b></p> <p>Relevant documents related to project design have not been provided to DNV. The following documents is therefore requested:</p> <ul style="list-style-type: none"> <li>- copy of the Feasibility Study, in particular the part that presents the estimation of plant capacity, plant generation per year and power dispatched to the grid</li> <li>- picture of the generator and the turbine plates with the technical characteristics</li> <li>- registration of the plant in the National Electricity Agency</li> </ul>	A.2.1	<p>A copy of the feasibility study has been submitted (see attached file FUI 1 – Quilleco feasibility study.pdf) Original name of the Project is Tucapel</p> <p>Pictures have been submitted (see attached file FUI 2 – Quilleco pictures.zip)</p> <p>A copy of the fax sent to the National Electricity Agency (CDEC-SIC) to register the project activity and formalize its commissioning has been submitted (see attaches file FUI 3 - Registro CDEC-SIC.pdf)</p>	The necessary documents were provided to DNV's satisfaction. CL closed
<p><b>CL 15</b></p> <p>The starting date of a project activity is the earliest of implementation, construction and real action. Evidence for this is requested.</p>	C.1.1	The starting date has been updated in the PDD as 26 October 2004.	Evidences of project approval in 26 October 2004 have been provided. Therefore this CL is closed.

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## **APPENDIX B**

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### **CERTIFICATES OF COMPETENCE**



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## CERTIFICATE OF COMPETENCE

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***Hendrik Brinks***

Qualification in accordance with DNV's Qualification scheme for CDM/JI (ICP-9-8-i1-CDMJ1-i1)

<b>GHG Auditor:</b>	Yes		
<b>CDM Validator:</b>	Yes	<b>JI Validator:</b>	--
<b>CDM Verifier:</b>	--	<b>JI Verifier:</b>	--
<b>Industry Sector Expert for Sectoral Scope(s):</b>	Sectoral scope 1, 2, 3 & 12		
<b>Technical Reviewer for (group of) methodologies:</b>			
ACM002, AMS-I.A-D, AM0019, AM0026, AM0029, AM0045	Yes	AM0013, AM0022, AM0025, AM00379, AMS-III.H, AMS- III.I	Yes
ACM0006, AM0007, AM0015, AM0036, AM0042	Yes		

Høvik, 18 July 2007

Einar Telnes  
*Director, International Climate Change Services*

Michael Lehmann  
*Technical Director*



# CERTIFICATE OF COMPETENCE

***Einar Telnes***

Qualification in accordance with DNV's Qualification scheme for CDM/JI (ICP-9-8-i1-CDMJI-i1)

<b>GHG Auditor:</b>	Yes		
<b>CDM Validator:</b>	Yes	<b>JI Validator:</b>	--
<b>CDM Verifier:</b>	Yes	<b>JI Verifier:</b>	--
<b>Industry Sector Expert for Sectoral Scope(s):</b>	Sectoral scope 1, 2, 3 6 & 10		
<b>Technical Reviewer for (group of) methodologies:</b>			
ACM0001, AM0002, AM0003, AM0010, AM0011, AM0012, AMS-III.G	Yes	AM0027	Yes
ACM002, AMS-IA-D, AM0019, AM0026, AM0029, AM0045	Yes	AM0028, AM0034	Yes
ACM003, ACM0005, AM0033, AM0040	Yes	AM0030	Yes
ACM0004	Yes	AM0031	Yes
ACM0006, AM0007, AM0015, AM0036, AM0042	Yes	AM0032	Yes
ACM0007	Yes	AM0035	Yes
ACM0008	Yes	AM0038	Yes
ACM0009, AM0008, AMS-III.B	Yes	AM0041	Yes
AM0006, AM0016, AMS-III.D, ACM0010	Yes	AM0034	Yes
AM0009, AM0037	Yes	AM0043	
AM0013, AM0022, AM0025, AM00379, AMS-III.H, AMS-III.I	Yes	AM0046	
AM0014	Yes	AM0047	
AM0017	Yes	AMS-II.A-F, AM0044	Yes
AM0018	Yes	AMS-III.A	Yes
AM0020	Yes	AMS-III.E, AMS-III.F	Yes
AM0021	Yes		
AM0023	Yes		
AM0024	Yes		

Høvik, 5 February 2007

Einar Telnes  
Director, International Climate Change Services

Michael Lehmann  
Technical Director



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## CERTIFICATE OF COMPETENCE

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***Felipe Antunes***

Qualification in accordance with DNV's Qualification scheme for CDM/JI (ICP-9-8-i1-CDMJI-i1)

<b><i>GHG Auditor:</i></b>	Yes		
<b><i>CDM Validator:</i></b>	--	<b><i>JI Validator:</i></b>	--
<b><i>CDM Verifier:</i></b>	--	<b><i>JI Verifier:</i></b>	--
<b><i>Industry Sector Expert for Sectoral Scope(s):</i></b>	--		

Høvik, 5 February 2007

Einar Telnes  
*Director, International Climate Change Services*

Michael Lehmann  
*Technical Director*



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## CERTIFICATE OF COMPETENCE

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***Luis Filipe Tavares***

Qualification in accordance with DNV's Qualification scheme for CDM/JI (ICP-9-8-i1-CDMJI-i1)

<b><i>GHG Auditor:</i></b>	Yes		
<b><i>CDM Validator:</i></b>	Yes	<b><i>JI Validator:</i></b>	--
<b><i>CDM Verifier:</i></b>	Yes	<b><i>JI Verifier:</i></b>	--
<b><i>Industry Sector Expert for Sectoral Scope(s):</i></b>	Sectoral scope 9 & 13		

Høvik, 6 November 2006

Einar Telnes  
*Director, International Climate Change Services*

Michael Lehmann  
*Technical Director*