



**CLEAN DEVELOPMENT MECHANISM  
SIMPLIFIED PROJECT DESIGN DOCUMENT  
FOR SMALL-SCALE PROJECT ACTIVITIES (SSC-CDM-PDD)  
Version 02**

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**SECTION A. General description of the small-scale project activity****A.1. Title of the small-scale project activity:****>> A.1 Title of the project activity:**

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Cuchildeo Hydroelectric Project

**Version: 2, May 5<sup>th</sup> 2006****A.2. Description of the small-scale project activity:**

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The Cuchildeo Hydroelectric Project is a small run-of-river hydroelectric project located in the Tenth region of Chile, Los Lagos, being developed by Inversiones BEC S.A. The project will have an installed capacity of 0.8MW and will depend on the flow of water from the Cuchildeo River to generate electricity for the Municipality of Hualaihué. The Cuchildeo River basin receives approximately 3,500 mm, of rainfall annually. The purpose of the Cuchildeo Hydroelectric project is to optimize the use of the region's hydraulic resources by generating hydroelectricity.

Development of the Cuchildeo Hydroelectric Project will directly reduce greenhouse gas emissions produced by the current diesel electricity generation in the region. With an average annual generation of approximately 6139 MWh, the Project will reduce emissions by 4911 tons of CO<sub>2</sub>e per year.

The objectives motivating the project activity are several fold. First, the project aims to utilize the region's hydraulic resources to generate renewable for the municipality of Hualaihué. Second, the project plans to recondition and improve the defunct canals and civil works corresponding to an existing hydroelectric project that was constructed in 2000 but never entered into operation. The third objective is to achieve sustainable electricity prices for the 1,500 households in Hualaihué, that have historically paid roughly 400% of the average cost per kilowatt hour in the areas of the X Region connected to Chile's Central Interconnected Electric System (SIC).<sup>1</sup> Fourth, the project has the goal of contributing to sustainable development of the municipality and especially the community of Hornipirén through employment opportunities, renewable energy generation and cost savings.

The direct contributions of the project activity will facilitate sustainable development of the municipality in several ways. First, the project will utilize existing renewable resources to directly replace electricity generation from diesel, therefore avoiding emissions of greenhouse gases as well as other harmful effluents that result from diesel fired power plants: diesel residues, particulate matter, sulfur dioxide and nitrogen dioxide. The impacts of the diesel plants in the business-as-usual scenario are negatively effecting human and environmental health in the near vicinity, as well as contributing to global warming. The community of Hornipirén complains of water contamination by diesel oil that leaks from the plant and enters the Cuchildeo River. In addition, the diesel plants are located within the community and generate constant noise pollution. Second, the project will build and operate run-of-the-river technology

<sup>1</sup> Osses, Hernan. "Por incumplimiento de contrato demandaron a Saesa." *Diario Llanquihue*. 24 July 2005.

<[http://www.diariollanquihue.cl/prontus4\\_notas/antialone.html?page=http://www.diariollanquihue.cl/prontus4\\_notas/site/artic/20050801/pags/20050801225341.html](http://www.diariollanquihue.cl/prontus4_notas/antialone.html?page=http://www.diariollanquihue.cl/prontus4_notas/site/artic/20050801/pags/20050801225341.html)>



that has significantly less environmental impacts than both thermoelectric and large-scale reservoir-associated hydroelectric technology. Third, the project will stimulate the local economy by providing jobs. Furthermore, by reducing and making the generation costs of electricity sustainable for residents and local businesses, the project activity will facilitate the economic growth in the rural municipality of Hualaihué. Historically, the municipality of Hualaihué has paid up to \$296 Chilean pesos for the same kilowatt-hour for which their urban neighbors in Puerto Montt 100km away have paid \$75 Chilean pesos. Recently, the prices in Hualaihué have been reduced by a political decision to subsidize the prices in Hualaihué through charging higher rates in Puerto Montt. However, this political agreement is contingent upon the elected politicians and is not a long-term solution for the region.

The project site is located in the center of the community of Hornipirén in the municipality of Hualaihué, which has approximately 8,300 inhabitants. The Cuchildeo River runs north-south through the community of Hornipirén. The project activity will provide employment for 20 local laborers during construction and three technicians during operations. Project construction is estimated to last between 6 and 7 months. Health and safety is a priority of the project developer, and the construction workers will have accident insurance as well as health care through their employers as it is a requisite for winning the construction contract with Inversiones BEC S.A.

### **A.3. Project participants:**

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Please list project participants and Party(ies) involved and provide contact information in Annex 1. Information shall be indicated using the following tabular format.

Name of Party involved (*) (host) indicates a host Party)	Private and/or public entity(ies)  I. Project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant
Chile (host)	Inversiones BEC S.A. Santiago, Chile	No
UK	EcoSecurities, Ltd.	No

(\*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.

**Note:** When the PDD is filled in support of a proposed new methodology (forms CDM-NBM and CDM-NMM), at least the host Party(ies) and any known project participant (e.g. those proposing a new methodology) shall be identified.

### **A.4. Technical description of the small-scale project activity:**

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The Cuchildeo hydroelectric plant was originally constructed in 2000 with the goal of providing electricity to the community of Hornipirén. However, due to lack of funding as well as lack of hydroelectric engineering know-how, upon completion the hydroelectric plant was deemed to be



dysfunctional and incapable of operation. Since the abandonment of the hydroelectric plant in 2000, the non-functional power house and canal system have been left to rust and deteriorate along the River.

In order to make the Cuchildeo plant viable, the project developer will replace the technological components of the original plant and recondition the remaining civil works. The small-scale run-of-the-river project activity will employ a small diversion wall with the main water intake along the Cuchildeo River. The Diversion dam consists of a 2 meter (m) high, 18.5m wide and 8m long concrete structure that will divert water from the Cuchildeo River through a collector channel 584m long. The intake will conduct 11 m<sup>3</sup>/s of water into a headrace chamber, which regulates the intake level to eliminate excess air from the water before it enters the intake tunnel. The 1.9m diameter, 15m long intake canal will conduct the 11 m<sup>3</sup>/s of water with a gross head is 9.66m into the powerhouse. Upon exiting the powerhouse, the water will return to the Cuchildeo River through a tailrace channel 350m in length.

Inside the powerhouse, the water will spin a 0.8 MW S-turbine and generate electricity through the synchronic generator. The electricity generated by the project activity will be transmitted through a step up transformer to the 23 kv transmission line connecting to the Hornipirén Station, which will dispatch the electricity to the local grid.

Nominal Data:

Installed Capacity	0.8 MW
Average annual generation:	6.1 GWh
Design head:	9.8 m
Number of units:	1 S-Turbine
Powerline:	23 kv

**A.4.1. Location of the small-scale project activity:**

>>  
South America

**A.4.1.1. Host Party(ies):**

>>  
Chile

**A.4.1.2. Region/State/Province etc.:**

>>  
Palena, Region X

**A.4.1.3. City/Town/Community etc:**

>>  
Hornipirén, Municipality of Hualaihué

**A.4.1.4. Detail of physical location, including information allowing the unique identification of this small-scale project activity(ies):**

&gt;&gt;

The Cuchildeo Hydroelectric Project is located roughly 100km from the city of Puerto Montt in the Community of Hornipirén, Municipality of Hualaihué, Province of Palena in the X Region. The project site is accessible from route R7 along the Carretera Austral that begins in Puerto Montt and runs Southeast along the coast. To access Hornipirén it is necessary to take a ferry from La Arena to Puelche in order to continue along the Carretera Austral until Hornipirén.

The Cuchildeo watershed is located in the Southeastern part of the Region X of Chile. The Cuchildeo hydroelectric plant is located between the following 1956 UTM coordinates: 5352820N and 708880E using the reference point in Chile of 1956 and the angle plane of 18. Geographically, the Cuchildeo River basin is situated a long side the Hornipirén volcano and is comprised of the Cuchildeo River, Verde Lake, Maule Lake and Cabrera Lake, whose river outlet continues down the valley to the Cuchildeo project site.

**A.4.2. Type and category(ies) and technology of the small-scale project activity:**

&gt;&gt;

The category for the project activity according to the UNFCCC's published simplified procedures for small-scale activities is Type 1D – Renewable Electricity Generation for a Grid. The project conforms to the project category since the nominal installed capacity of the Cuchildeo project is below the 15 MW threshold and the plant will sell its generated electricity to the local grid.

One horizontal S-turbine with 0.8 MW of nominal power will be used.

**A.4.3. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed small-scale project activity, including why the emission reductions would not occur in the absence of the proposed small-scale project activity, taking into account national and/or sectoral policies and circumstances:**

&gt;&gt;

The inclusion of the Cuchildeo Hydroelectric Project with its 0.8 MW of installed capacity and an average 6.1 GWh annual generation will directly reduce the greenhouse gases emissions produced by the diesel generators that are currently in operation in the region. Under the business as usual scenario the diesel generators would continue to operate in order to provide electricity to the Hualaihué municipality in absence of connection to the Chile's dominant electricity grid, the Central Interconnected System (SIC).

**A.4.3.1 Estimated amount of emission reductions over the chosen crediting period:**



&gt;&gt;

Please indicate the chosen crediting period and provide the total estimation of emission reductions as well as annual estimates for the chosen crediting period. Information on the emissions reductions shall be indicated using the following tabular format.

For type (i) small-scale projects the estimation of project emissions is also required.

Years	Annual estimation of emission reductions in tonnes of CO <sub>2</sub> e
Year 1	4911
Year 2	4911
Year 3	4911
Year 4	4911
Year 5	4911
Year 6	4911
Year 7	4911
<b>Total estimated reductions (tonnes of CO<sub>2</sub>e)</b>	34377
<b>Total number of crediting years</b>	7 (renewable up to 21 years)
<b>ANNUAL AVERAGE OVER THE CREDITING PERIOD OF ESTIMATED REDUCTIONS (TONNES OF CO<sub>2</sub>E)</b>	4911

#### **A.4.4. Public funding of the small-scale project activity:**

&gt;&gt;

This project has not received and is not seeking any public funding.

#### **A.4.5. Confirmation that the small-scale project activity is not a debundled component of a larger project activity:**

&gt;&gt;

Based on the information provided in Appendix C of the simplified modalities, this Project is not a debundled component of a larger project activity since the project participants have not registered or operated another project in the region surrounding the project boundary.

### **SECTION B. Application of a baseline methodology:**

#### **B.1. Title and reference of the approved baseline methodology applied to the small-scale project activity:**

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Project Activity category I.D. “Renewable electricity generation for a grid.” As outlined in paragraph 7 of Annex B of the simplified modalities and procedures for small-scale CDM project activities.

#### **B.2 Project category applicable to the small-scale project activity:**

&gt;&gt;



Appendix B of the simplified modalities and procedures for CDM small-scale project activities offers the following formula for preparing the baseline calculation for this type of project activity:

Project Activity category I.D. Renewable electricity generation for a grid; *For a system where all generators use exclusively fuel oil and/or diesel fuel, the baseline is the annual kWh generated by the renewable unit times an emission coefficient for a modern diesel generating unit of the relevant capacity operating at optimal load as given in Table I.D.1.*

The correct emission coefficient is 0.80 since the grid is larger than 200 kW.

**B.3. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:**

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*MARKET SITUATION:*

The municipality of Hualaihué in the province of Palena in the X Region of Chile is outside the boundary of the country's interconnected electricity systems. Chile's privatized electricity sector is divided into four main subsystems: the SING (Great Northern Interconnected System), the SIC (Central Interconnected System), and two local systems in the southern regions of Aysen and Magallanes. The SIC is the largest of the four, covering the most populated regions of Chile and providing electricity to roughly 90% of Chilean consumers. While the aforementioned grids are generally characterized by a mix of thermoelectric and hydroelectric generation, with the largest, the SIC, comprised of almost 60% hydroelectric generation, the Saesa's local system serving the Hualaihué municipality generates electricity using 100% diesel fuel.

The generation of electricity using solely diesel fuel has two principle consequences: extremely high costs to energy consumers and environmental pollution. Saesa's 1,500 clients in the Hualaihué municipality have historically paid an average of \$297 Chilean Pesos per kilowatt hour, whereas those in the neighbouring city of Puerto Montt have paid \$75.<sup>2</sup> Furthermore, the combustion of diesel fuel to generate electricity results in the emission of greenhouse gases, nitrogen dioxide and sulphur dioxide, as well as particulate matter, which are damaging to human health and the environment. In an effort to ameliorate these effects, the Chilean government has for years discussed the possibility of connecting the municipality to the SIC, but the region remains isolated from the national grid.<sup>3</sup> On the other hand, regional representatives have demanded that privately owned Saesa S.A. reduce their prices; however, the electricity costs largely reflect high diesel process and higher generation costs.

In December 2005, the socio-political discussions finally reached a temporary resolution requiring the residents of Puerto Montt to subsidize the electricity costs of the Hualaihué municipality in the form of higher costs per kilowatt hour. However, this solution is dependent on a political agreement between the regional representatives rather than law and is therefore not sustainable indefinitely. Saesa S.A. continues

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<sup>2</sup> Toloza Jiménez, Victor. "Hualaihué protestó por tarifas eléctricas y anuncian recurso legal." *Diario Llanquihue*. 1 August 2005.

<[http://www.diariollanquihue.cl/prontus4\\_not/antialone.html?page=http://www.diariollanquihue.cl/prontus4\\_not/site/artic/20050801/pags/20050801225341.html](http://www.diariollanquihue.cl/prontus4_not/antialone.html?page=http://www.diariollanquihue.cl/prontus4_not/site/artic/20050801/pags/20050801225341.html)>

<sup>3</sup> Osses, Hernan. "En 60% bajará tarifa eléctrica en comunas de Cochamó y Hualaihué." *Diario Llanquihue*. 25 August 2005.

<[http://www.diariollanquihue.cl/prontus4\\_not/antialone.html?page=http://www.diariollanquihue.cl/prontus4\\_not/site/artic/20050801/pags/20050801225341.html](http://www.diariollanquihue.cl/prontus4_not/antialone.html?page=http://www.diariollanquihue.cl/prontus4_not/site/artic/20050801/pags/20050801225341.html)>



to generate electricity at the same exorbitant costs and the diesel generators continue polluting, even though electricity prices are now lower for residents of the Hualaihué municipality..

Considering the region's heavy rainfall and extensive waterways, the utilization of the region's hydroelectric potential would resolve the problems associated with thermoelectricity. However, significant barriers exist to the development of small-hydro and run-of-the-river power plants. The large capital costs of constructing, as well as the studies required by law, inhibit small developers from building hydroelectric plants. The region encompassing Hornipirén further hinders potential development due to its inaccessibility and limited consumer base.

#### *ADDITIONALITY:*

According to Attachment A to Appendix B of the simplified modalities and procedures for CDM small-scale project activities evidence to why the proposed project is additional is offered under the following categories of barriers: (a) investment barrier, (b) technological barrier, and (c) prevailing practice.

##### a) Investment Barrier:

Access to credit and investments in Chile are geared towards large-scale electric projects with attractive IRR's, or relatively short pay-off periods. Local banks charge high interest rates for projects of this nature with high risk and low IRR's. Given the lack of access to capital, energy systems with high up-front capital expenditures (such as hydro) are particularly challenging in this environment. The costs of the Cuchildeo hydroelectric project are also higher and the ability to obtain credit more challenging because of limited access to the Hualaihué region as well as lack of local resources.

Inversiones BEC S.A. will invest almost US\$1,500,000 in order to recondition and improve the existing civil works of the original Cuchildeo hydroelectric plant as well as construct the necessary works absent from the original design and purchase the essential machinery like a new hydroelectric turbine. Due to the low annual GWh and the low price of electricity, the project's IRR without carbon credits is 6.6%. Evaluating the project in the absence of carbon credits makes it unprofitable for investment. The IRR of the project improves from 6.6% to 17.6% with carbon revenue.

This important increase on the project's financial return is given by the fact that without carbon revenue the project developer does not expect significant positive flows during the first 7 years; additionally, negative cash flows are expected until years 8 to 10. Important positive cash flows are expected after 11 years from the construction date. Consequently, carbon revenues modified this negative cash flow trend during the first 7 years to a positive cash flow from year one. The latter explains the significant improvement on the financial return of the project.

Inversiones BEC S.A. specifically included the development of this project as a CDM activity and the inclusion of CERs in the project portfolio as means to acquire approval from the Board of Directors for the construction of a small-scale hydroelectric project with minimal environmental impacts. The development of the project as a CDM activity increased the project's financial attractiveness by promising a hard currency revenue stream that is critical to any project's development.

##### b) Technological Barrier:



Run-of-the-river hydroelectric technology is a barrier to development because it poses a greater hydraulic risk to the project owner than its large-scale dam associated counterpart. By employing run-of-the-river hydroelectric technology, the project owner relinquishes the ability to control the amount of electricity that the plant will generate. Without a dam, which offers a mechanism to strategically control the flow of water, a run-of-the-river hydroelectric plant is vulnerable to low rainfall during drought years. Similarly, run-of-the-river technology generates financial risk because less than anticipated rainfall reduces the annual gigawatt hours of electricity dispatched to the grid, substantially impacting the IRR. In this particular case, the project's hydrologic study reveals that a drought – which significantly diminishes the river flow – occurs one out of eight years (12.5% of years). Considering that the Cuchildeo hydroelectric plant is expected to operate for 50 years, the frequency of drought will reduce the electricity generation throughout the project's lifetime. The risk of drought 12.5% of the years that the project operates increases its financial risk, which acts as a technological barrier for run-of-the-river technology that is unable to regulate flow in drought years.

In addition, other technological barriers to small-scale hydroelectric development in the Hualaihué municipality exist because of its isolation and low income characteristics. Residents of the Hualaihué municipality have limited access resources and training as well as lack of experience with concrete construction - due to the inaccessibility of concrete and the abundance of wood. In terms of hydroelectric plant construction residents have even less experience because there are no other hydroelectric plants in the near vicinity. This lack of experience is evident in the poor construction of the original Cuchildeo project that failed to become operational.

c) Prevailing Practice:

To examine the prevailing practice related to small-scale hydroelectric plants in Chile, it is important to review their history in Chile. The financing, construction and operation of small hydroelectric plants is not common practice in Chile. The financial sector resources are targeted for thermal electric plants and large scale hydro. In addition, electricity sector expertise and structure is also almost disproportionately focused on large scale hydro. Within the “short electricity law” recently established by the Chilean government achieving 5% of the electricity mix is set out as goal for small hydro. However, despite the Chilean government's initiatives to promote small-scale hydro as means of meeting the growing energy demand, in the absence of subsidies hydroelectric plants below 15MW represent only 1% of the electricity mix in the national grid.<sup>4</sup> This small percentage of the electricity mix reflects the barriers that small-hydro projects face in Chile.

The primary barriers within Chile and Inversiones BEC S.A. to small-scale hydro development are the unclear regulatory processes, risks to energy security (like hydraulic risk), and the difficulty of developing small projects. The Cuchildeo project clearly represents a scenario that is not business-as-usual.

Summary:

The current and expected practice of relying on solely thermal sources in the Hualaihué municipality, as well as the combination of investment, prevailing practice and strategic barriers, clearly demonstrate that the Cuchildeo project is additional and therefore not the baseline scenario. The CDM allows Cuchildeo to

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<sup>4</sup> Central Interconnected System – Load Economic Dispatch Center (CDEC-SIC). “Operation Statistic 1995-2004.” Santiago, Chile: CEDEC-SIC, 2004.



overcome these barriers and make its development possible. The prohibitive barriers to the development of similar projects in Chile are confirmed by the absence of a functional hydroelectric plant in the region.

**B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the small-scale project activity:**

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As referred to in Appendix B for small-scale project activities, the project boundary for a small scale hydropower project that provides electricity to a grid encompasses the physical, geographical site of the renewable generation source. For the Cuchildeo project this includes emissions from activities that occur at the project location.

The system boundary for the proposed project is defined as the interconnected system of the Hualaihué local system. The project boundary for the baseline will include all the direct emissions, being the emissions related to the electricity produced by the diesel facility to be replaced by the Cuchildeo project, displacing emissions from the fossil fuel power plant.

Conforming to the guidance and rules for small scale project activities, the emissions related to production, transport and distribution of the fuel used for the power plants in the baseline are not included in the project boundary as these do not occur at the physical and geographical site of the project. For the same reason the emissions related to the transport of the fuel are also excluded from the project boundary.

**B.5. Details of the baseline and its development:**

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As specified for project category Type I.D (AMS-I.D) - “*Grid connected renewable electricity generation*” (Version 8).

Date of completing the final draft of this baseline section: 2/15/2006

Name of person/entity determining the baseline:

Julie McLaughlin, EcoSecurities Ltd (Tel:+56 2 207 5000, julie@ecosecurities.com).

**SECTION C. Duration of the project activity / Crediting period:**

**C.1. Duration of the small-scale project activity:**

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The construction of Cuchildeo Hydroelectric project is planned to start in May 2006 and will be in operation by June 2007.

**C.1.1. Starting date of the small-scale project activity:**

>>

Starting date (DD/MM/YYYY): 01/05/2006

**C.1.2. Expected operational lifetime of the small-scale project activity:**



>>  
50y-0m

**C.2. Choice of crediting period and related information:****C.2.1. Renewable crediting period:**

>>  
The project activity will use a renewable crediting period of seven years.

**C.2.1.1. Starting date of the first crediting period:**

>>  
Starting date (*DD/MM/YYYY*): 01/6/2007

**C.2.1.2. Length of the first crediting period:**

>>  
7y-0m

**C.2.2. Fixed crediting period:**

>>  
Not Applicable

**C.2.2.1. Starting date:**

>>  
Not Applicable, see C.2.1.1

**C.2.2.2. Length:**

>>  
Not Applicable, see C2.1.2

**SECTION D. Application of a monitoring methodology and plan:**

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**D.1. Name and reference of approved monitoring methodology applied to the small-scale project activity:**

>>  
Metering the electricity generated as described in the Simplified Procedures for small scale CDM projects activities for Type ID Projects (Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories Version 8).

**D.2. Justification of the choice of the methodology and why it is applicable to the small-scale project activity:**

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The methodology was selected as suggested by the Simplified Monitoring Methodologies for small-scale CDM projects. Measuring and recording the amount of electricity supplied to the buyer is the most accurate method of monitoring the project.



**D.3 Data to be monitored:**

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**Table 4:** Data to be collected in order to monitor emissions reductions from the project activity, and how this data will be archived

ID n°	Data type	Data variable	Data unit	Calculated (c) Indicated (I)or Measured (m), Estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data to be kept?	Comment
D.3.1	Electricity	Electricity Generation of the Project delivered to the Grid	MWh	M	Continuous	100%	Electronic and paper	During the whole crediting period + 2 years	Monitored by meters and through the electricity bill by the distribution company

**The monitoring will be conducted according to Section 11 of ‘Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories’ Version 8.**

**D.4. Qualitative explanation of how quality control (QC) and quality assurance (QA) procedures are undertaken:**

&gt;&gt;

The electricity generated by the Project will be supplied to the local electricity system of the Hualaihué municipality. According to 'Guidance related to monitoring requirements' (EB 23, Paragraph 24), to ensure accuracy, a metering instrument will be installed. The metering system will comply with technical specifications for commercial metering. The metering requirements are defined by the Chilean electricity law and are regulated by Saesa. These data will be directly used for calculation of emission reductions. Sales records to the grid and other records are used to ensure consistency.

**D.5. Please describe briefly the operational and management structure that the project participant(s) will implement in order to monitor emission reductions and any leakage effects generated by the project activity:**

&gt;&gt;

The Project Developer will have a designated engineer on site that will be responsible for monitoring emissions reductions of the project activity. No leakage is expected.

- The proven and qualified monitoring equipment (electricity meter) will be installed in place. The systems will allow automated and continuous recording and reporting of data. These readings will be checked for any anomalies before being filed for future reference.
- The data will be monitored and recorded by qualified technicians according to the monitoring plan. Electricity records will be double checked with the local Saesa, Hualaihué electricity system.
- The data will be electronically archived. Receipts of electricity sales will be obtained.

Proper management process and routine procedures are in place to ensure the quality of reports required by verification audits. The plant operator will monitor the electricity generation for Cuchildeo hydroelectric plant by reading the meter at the Hornipirén station. These readings will be recorded daily. Furthermore, the Saesa plant operator will calibrate and maintain the electricity meter in accordance with Chilean authorities.

**D.6. Name of person/entity determining the monitoring methodology:**

&gt;&gt;

The monitoring methodology was prepared by:

Julie McLaughlin, EcoSecurities Ltd (Tel:+56 2 207 5000, julie@ecosecurities.com).

**SECTION E.: Estimation of GHG emissions by sources:****E.1. Formulae used:****E.1.1 Selected formulae as provided in appendix B:**



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The Cuchildeo project is based on electricity generation for a grid by a small hydraulic turbine. Appendix B provides a formula for calculating the baseline for a Type I.D. project in mini-grids where all generators use exclusively fuel oil and/or diesel fuel.

**E.1.2 Description of formulae when not provided in appendix B:**

>>

Formulae are provided in appendix B.

**E.1.2.1 Describe the formulae used to estimate anthropogenic emissions by sources of GHGs due to the project activity within the project boundary:**

>>

No formula is used. Emissions by sources are zero since hydroelectric power is a CO<sub>2</sub>-neutral energy source.

**E.1.2.2 Describe the formulae used to estimate leakage due to the project activity, where required, for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities**

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Leakage does not need to be considered in the case of this Project. This renewable energy technology used is not equipment transferred from another activity. Furthermore, although the project developer will be replacing the turbine which was installed for the initial project in 2000, the turbine being replaced and removed from the project site has never functioned. Therefore, it will not, and cannot, be used in another project activity, eliminating the need to consider leakage from this potential source. As per the Simplified Procedures for small scale CDM project activities, no leakage calculation is required.

**E.1.2.3 The sum of E.1.2.1 and E.1.2.2 represents the small-scale project activity emissions:**

>>

Zero emissions

**E.1.2.4 Describe the formulae used to estimate the anthropogenic emissions by sources of GHGs in the baseline using the baseline methodology for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities:**

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Baseline emissions, E<sub>baseline</sub>, are given by:

$$E_{\text{baseline}} \text{ (t CO}_2\text{/yr)} = \langle E \rangle_{\text{baseline}} \text{ (t CO}_2\text{/MWh)} * CEG \text{ (MWh/yr)}$$

Where CEG stands for Cuchildeo’s electricity generation; and

$\langle E \rangle_{\text{baseline}}$  is the provided standard emission coefficient 0.80 according to Table I.D.1 in Appendix B

**E.1.2.5 Difference between E.1.2.4 and E.1.2.3 represents the emission reductions due to the project activity during a given period:**

&gt;&gt;

Emission reductions are achieved from the equation in section E.1.2.4.

Emission reductions of project activity are

$$0.80 \text{ tons CO}_2/\text{MWh} * 6193 \text{ MWh/year} * 0.876 \text{ (plant factor)} = 4911 \text{ tons CO}_2/\text{year}$$

**E.2 Table providing values obtained when applying formulae above:**

&gt;&gt;

Based on Inversiones BEC S.A.'s assumptions and findings in the Hydrologic Study the installed capacity will be 0.8 MW and the plant operating capacity (load factor) is 87.6%. Therefore the Project has an annual electricity generation of 6139.008 MWh per year, calculated as follows:

$$0.8 \text{ MW} * 8,760 \text{ hours/year} * 87.6\% = 6139.008 \text{ MWh per year}$$

*The baseline emissions are:*

$$0.80 \text{ tons CO}_2/\text{MWh} * 6193 \text{ MWh/year} = 4911 \text{ tons CO}_2/\text{year}$$

Installed Capacity (MW)	Load Factor	MWh per Year	Carbon Emission Factor (CO <sub>2</sub> /MWh)	Tons of CO <sub>2</sub> equivalent
0.8	0.876	6139	0.8	4911

**SECTION F.: Environmental impacts:****F.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:**

&gt;&gt;

An Environmental Impact Declaration (DIA) was completed in accordance with Chilean law for the project and is available in both electronic and hard copy in Spanish. A copy of the DIA will be provided to the Operational Entity validating the project. The DIA is expected to receive approval from the appropriate Chilean authorities by June 2006. In turn, the environmental impacts of the project identified in the DIA were followed by defined mitigation measures that will be undertaken by Inversiones BEC S.A..

**Construction Phase:**

The majority of environmental impacts identified in the DIA are associated with the project's construction phase. The main environmental impacts that the construction phase is likely to cause include



the liberation of sediments and particulate matter, the generation of liquid and solid wastes, and the intervention of machines in terrestrial and aquatic ecosystems. Nevertheless, the project's impacts will be minimal because the majority of the excavation and intervention at the project site were done during the original construction. The canals have been dug, the road has been cleared and the transmission lines installed.

In order to mitigate the environmental impacts of the hydroelectric project Inversiones BEC S.A. will reforest the hillsides surrounding the project site with special attention to those areas bordering the canals. Reforestation will improve the current conditions of the projects site, which are a result of careless excavation and absence of environmental mitigation measures on the part of the first Cuchildeo hydroelectric developer.

During construction, Inversiones BEC S.A. will undertake several mitigation measures in order to minimize the environmental impact of the project. First, all industrial wastes will be handled according to applicable health and environmental regulations and disposed of appropriately in the town of Hornipirén. Second, all fuel changes, mechanical repairs and maintenance will be conducted in conditioned facilities within the town of Hornipirén. Finally, during the construction phase, Inversiones BEC S.A. will install a filter in order to mitigate all sediment entering the water stream during construction.

#### Operation Phase:

The environmental impacts that the project is expected to have during operations are minimal and are related to the alteration of hydraulic conditions in the segment of the river where the project will operate. The project activity is also likely to generate small amounts of solid wastes during operation. The maintenance of the powerhouse will periodically require the use of oils and lubricants which will be safely stored and removed from the project site in accordance with Chilean law. Similarly, the generation of domestic and industrial solid wastes will also be disposed of in a safe and appropriate manner.

Even though the environmental impacts of the project activity during operation are expected to be negligible, Inversiones BEC S.A. will continue to monitor water quality as well as the surrounding region for environmental health.

### **SECTION G. Stakeholders' comments:**

#### **G.1. Brief description of how comments by local stakeholders have been invited and compiled:**

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The consultation event was programmed for the 2 of February 2006 in order to present the basic concepts related to climate change and the Kyoto Protocol and its consequences, as well the most important features of the project undertaken by Inversiones BEC S.A to the project stakeholders. Specific invitations were sent to local authorities, environmental NGOs and local branch of Chile's environmental protection agency requesting their attendance at the consultation event. In addition an open invitation for the public was posted in the community of Hornipirén where the project will be constructed.

The event was planned in a meeting room and consisted of a presentation in which Inversiones BEC S.A. representatives addressed climate change issues and the Clean Development Mechanism and the main features and impacts of the "Project." Despite the public and targeted invitations, the consultation event was poorly attended. The town the urban center of Hornipirén has a small population of approximately



1,120 with the remaining 7,180 dispersed throughout the rural regions of the Hualaihué municipality. In the absence of enthusiastic participation from the municipality, Inversiones BEC S.A. made the presentation to the mayor's office as well as local business owners and passersby. The questions and comments received from these residents is summarized below.

### G.2. Summary of the comments received:

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The main questions posed by the participating stakeholders were related to:

- 1) The project site and its proximity to the town of Hornipirén.
- 2) The number of technical and manual labor jobs that would be provided for local residents.
- 3) The annual GWh of electricity that the project would generate and its capacity to provide electricity for Hornipirén residents.

The main comments received from participants were positive, noting that the implementation of the project activity would resolve many of the existing problems that residents had with the diesel generators. First, participants mentioned that the Cuchildeo hydro plant will cause less river contamination by obviating the diesel oil that is used and leaked from the generators. Second, the noise pollution will be much less than the constant clatter produced by the diesel generators. Third, the project activity will ensure long term price stability for electricity in the community. Finally, the project activity is much less detrimental to the local environmentally than the diesel generators.

### G.3. Report on how due account was taken of any comments received:

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All comments made by Hornipirén residents were recorded by the consultation event organizers. Questions were answered immediately during the discussion period.

## Annex 1

### CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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**Annex 2**

**INFORMATION REGARDING PUBLIC FUNDING**

There is no public funding used in this project.

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