Appendix A[1] to the simplified modalities and procedures for small-scale CDM project activities

CLEAN DEVELOPMENT MECHANISM
SIMPLIFIED PROJECT DESIGN DOCUMENT
FOR SMALL SCALE PROJECT ACTIVITIES (SSC-PDD)
Version 01 (21 January, 2003)

Pesqueiro Energia Small Hydroelectric Project

Jaguariaíva, Paraná, Brazil

Project sponsor: Pesqueiro Energia S. A.

Prepared by Ecoinvest

[1] This appendix has been developed in accordance with the simplified modalities and procedures for small-scale CDM project activities (contained in annex II to decision 21/CP.8, see document FCCC/CP/2002/7/Add.3) and it constitutes appendix A to that document. For the full text of the annex II to decision 21/CP.8 please see http://unfccc.int/cdm/ssc.htm).

Introductory Note

1. This document contains the clean development mechanism project design document for small-scale project activities (SSC-PDD). It elaborates on the outline of information in appendix B "Project Design Document" to the CDM modalities and procedures (annex to decision 17/CP.7 contained in document FCCC/CP/2001/13/Add.2) and reflects the simplified modalities and procedures (herewith referred as simplified M&P) for small-scale CDM project activities (annex II to decision 21/CP.8 contained in document FCCC/CP/2002/7/Add.3).
2. The SSC-PDD can be obtained electronically through the UNFCCC CDM web site (http://unfccc.int/cdm/ssc.htm), by e-mail (cdm-info@unfccc.int) or in print from the UNFCCC secretariat (Fax: +49-228-8151999).
3. Explanations for project participants are in italicized font *(e.g. explanation).*
4. The Executive Board may revise the SSC-PDD if necessary. Revisions shall not affect small-scale CDM project activities validated prior to the date at which a revised version of the SSC-PDD enters into effect. Versions of the SSC-PDD shall be consecutively numbered and dated. The SSC-PDD will be available on the UNFCCC CDM web site in all six official languages of the United Nations.
5. In accordance with the CDM modalities and procedures, the working language of the Board is English. The completed SSC-PDD shall therefore be submitted to the Executive Board in English.
6. Small-scale activities submitted as a bundle, in accordance with paragraphs 9 (a) and 19 of the simplified M&P for small-scale CDM project activities, may complete a single SSC-PDD provided that information regarding A.3 (*Project participants*) and A.4.1 *(Location of the project activity)* is completed for each project activity and that an overall monitoring plan is provided in section D.
7. A small-scale project activity with different components eligible to be proposed[2] as a small-scale CDM project activity may submit one SSC-PDD, provided that information regarding subsections A.4.2 (*Type and category(ies) and technology of project activity*), and A.4.3 (*brief statement on how anthropogenic emissions of greenhouse gases (GHGs) by sources are to be reduced by the proposed CDM project activity)* and sections B *(Baseline methodology)*, D *(Monitoring methodology and plan)* and E *(Calculation of GHG emission reductions by sources)* is provided separately for each of the components of the project activity.
8. If the project activity does not fit any of the project categories in appendix B of the simplified M&P for small-scale CDM project activities, project proponents may propose additional project categories for consideration by the Executive Board, in accordance to paragraphs 15 and 16 of the simplified M&P for small-scale CDM project activities. The project design document should, however, only be submitted to the Executive Board for consideration after it has amended appendix B as necessary.
9. A glossary of terms may be found on the UNFCCC CDM web site or from the UNFCCC secretariat by e-mail (cdm-info@unfccc.int) or in print (Fax: +49-228-8151999).

[2] In paragraph 7 of simplified M&P for small-scale CDM project activities, on clarifications by the Executive Board on small-scale CDM project activities, the Board agreed that in a project activity with more than one component that will benefit from simplified CDM modalities and procedures, each component shall meet the threshold criterion of each applicable type, e.g. for a project with both a renewable energy and an energy efficiency component, the renewable energy component shall meet the criterion for "renewable energy" and the energy efficiency component that for "energy efficiency".

CONTENTS

A. General description of project activity

B. Baseline methodology

C. Duration of the project activity / Crediting period

D. Monitoring methodology and plan

E. Calculation of GHG emission reductions by sources

F. Environmental impacts

G. Stakeholders comments

Annexes

Annex 1: Information on participants in the project activity

Annex 2: Information regarding public funding

Annex 3: Figures

Annex 4: Tables

Annex 5: Bibliography

A. General description of project activity

A.1. Title of the project activity:

Pesqueiro Energia Small Hydroelectric Project (hereafter referred to as PESHP).

A.2. Description of the project activity:

The primary objective of the PESHP Project is to help meet Brazil's rising demand for energy due to economic growth and to improve the supply of electricity, while contributing to the environmental, social and economic sustainability by increasing renewable energy's share of the total Brazilian (and the Latin America and the Caribbean region's) electricity consumption.

The Latin America and the Caribbean region countries have expressed their commitment towards achieving a target of 10% renewable energy of the total energy use in the region. Through an initiative of the Ministers of the Environment in 2002 (UNEP-LAC, 2002), a preliminary meeting of the World Summit for Sustainable Development (WSSD) was held in Johannesburg in 1992. In the WSSD final Plan of Implementation no specific targets or timeframes were stated, however, their importance was recognized for achieving sustainability in accordance with the Millennium Development Goals[3].

The PESHP is located in the south of Brazil, where the largest coal reserves are located as well as the majority amount of thermo power plants using this fuel. The project consists of a small-hydro power plant (12.44 MW) located in the Jaguariaíva River, in the city of Jaguariaíva, state of Paraná. Jaguariaíva is a city with 33,837 inhabitants (IBGE, 2004) located next to the agricultural region of Ponta Grossa.

Pesqueiro Energia S.A is a special purpose company (SPC) which includes a run-of-river small hydro power plant and a very small reservoir (0.33 km²) with minor environmental impact. The entrepreneurship is a joint venture owned by three agricultural cooperatives. These agricultural cooperatives control three smaller cooperatives created specifically to commercialize the electricity. These three controlled cooperatives specialize in agricultural electrification have 2,500 km in transmission lines and commercialize more than 100,000 MWh per year. The number of associates is approximately 3,000 and the number of customers is more than 7,000. PESHP delivers about 80,000 MWh/year (with an estimated minimum capacity factor of 75%) to the South-Southeast-Midwest interconnected grid since February 2003.

This indigenous and cleaner source of electricity will also have an important contribution to environmental sustainability by reducing carbon dioxide emissions that would have occurred otherwise in the absence of the project. The project activity reduces emissions of greenhouse gas (GHG) by avoiding electricity generation by fossil fuel sources (and CO_2 emissions), which would be generating (and emitting) in the absence of the project.

3 WSSD Plan of Implementation, Paragraph 19 (e): "Diversify energy supply by developing advanced, cleaner, more efficient, affordable and cost-effective energy technologies, including fossil fuel technologies and renewable energy technologies, hydro included, and their transfer to developing countries on concessional terms as mutually agreed. With a sense of urgency, substantially increase the global share of renewable energy sources with the objective of increasing its contribution to total energy supply, recognizing the role of national and voluntary regional targets as well as initiatives, where they exist, and ensuring that energy policies are supportive to developing countries' efforts to eradicate poverty, and regularly evaluate available data to review progress to this end."

The PESHP Project improves the supply of electricity with clean, renewable hydroelectric power while contributing to the regional/local economic development. Small-scale hydropower run-of-river plants provide local distributed generation, in contrast with the business as usual large hydropower and natural gas fired plants built in the last 5 years, and these small-scale projects provide site-specific reliability and transmission and distribution benefits including:

- increased reliability and shorter and less extensive outages
- lower reserve margin requirements
- improved power quality
- reduced lines losses
- reactive power control
- mitigation of transmission and distribution congestion, and
- increased system capacity with reduced T&D investment.

It can be said that fair income distribution is achieved from job creation and an increase in people's wages, however better income distribution in the region where the PESHP Project is located is obtained from less expenditures and more income in the local municipalities. The surplus of capital that these municipalities will have could be translated into investments in education and health which will directly benefit the local population and indirectly impact a more equitable income distribution. The lower expenditure is generated due to the fact that money will no longer be spent in the same amount to "import" electricity from other regions in the country through the grid. This money would stay in the region and be used for providing the population better services which would improve the availability of basic needs. The local population will receive economic benefits from royalties paid to the municipalities for the water rights granted to PESHP.

A strong indication that PESHP contributes to the country's sustainable development goals is that the project is in accordance with the April 2002 law # 10,438 Proinfa (Programa de Incentivo as Fontes Alternativas de Energia Elétrica). Proinfa is a Brazilian federal program that gives incentive to alternative sources of electricity (wind energy, biomass cogeneration, and a small scale hydropower plant). Among other factors, this initiative's goal is to increase the renewable energy source share in the Brazilian electricity matrix in order to contribute to a greater environmental sustainability through giving these renewable energy sources better economic advantages. The Brazilian government has committed a large monetary fund in order to develop this plan.

Although PESHP is eligible for Proinfa, it has not applied for financing under Proinfa and therefore, does not have access to the advantages of the program.

A.3. Project participants:

- **Credit Owner and Project Operator:** Pesqueiro Energia S.A. authorized by Interministerial Commission on Global Climate Change (Brazilian Designated National Authority of the CDM). Brazil ratified the Kyoto Protocol on 23rd August 2002..

Contact information on party (ies) and private/public entities involved in the project activity listed in Annex 1.

A.4. Technical description of the project activity:

The Pesqueiro project utilizes water from the Jaguariaíva River to generate electricity (installed power, 12.44 MW). The facility contains a small dam (reservoir area = 0.33 km^2), which stores water in order to generate electricity for short periods of time. Run-of-River schemes do not include significant water storage, and must therefore make complete use of the water flow. A typical run-of-river scheme involves a low-level diversion dam and is usually located on swift flowing streams (Figure 1).

According to Eletrobrás (1999), run-of-river projects are defined as "the projects where the river's dry season flow rate is the same or higher than the minimum required for the turbines".

A low-level diversion dam raises the water level in the river sufficiently to enable an intake structure to be located on the side of the river. The intake consists of a trash screen and a submerged opening with an intake gate.

Water from the intake is normally taken through a pipe (called a penstock) downhill to a power station constructed downstream of the intake and at as low a level as possible to gain the maximum head on the turbine.

The technology employed at Pesqueiro project is established in the industry. The Francis turbine (Figure 4) is the most widely used among water turbines. This turbine is a type of hydraulic reactor turbine in which the flow exits the turbine blades in the radial direction. Francis turbines are common in power generation and are used in applications where high flow rates are available at medium hydraulic head. Water enters the turbine through a volute casing and is directed onto the blades by wicket gates. The low momentum water then exits the turbine through a draft tube. In the model, water flow is supplied by a variable speed centrifugal pump. A load is applied to the turbine by means of a magnetic brake, and torque is measured by observing the deflection of calibrated springs. The performance is calculated by comparing the output energy to the energy supplied.

The equipment and technology used in the PESHP Project has been successfully applied to similar projects in Brazil and around the world.

A.4.1. Location of the project activity

A.4.1.1. Host country party(ies):

Brazil

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

State of Paraná (South of Brazil)

A.4.1.3. City/Town/Community etc:

Jaguariaíva

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity:

The project is located in the south of Brazil, state of Paraná, city of Jaguariaíva (latitude 24º 15' 04" South and longitude 49º 42' 21" West, Figure 2), and uses using the hydro potential of the Jaguariaíva River. The Jaguariaíva River is part of the Paraná River basin (Figure 3).

A.4.2. Type and category(ies) and technology of project activity:

Type 1: Renewable energy projects

Category I.D.: Renewable energy generation for a grid.

PESHP uses the renewable hydro potential of the Jaguariaíva River to supply electricity to a distribution system (Brazilian South-Southeast-Midwest interconnected grid) that is supplied by at least one fossil fuel fired generating unit and has an installed capacity of 12.44 MW (below the eligibility limit of 15 MW for small scale projects). The equipment used in the project was developed and manufactured locally.

A.4.3. Brief statement on how anthropogenic emissions of greenhouse gases (GHGs) by sources are to be reduced by the proposed CDM project activity:

The PESHP, a greenhouse gas (GHG) free power generation project, will result in GHG emissions reductions as the result of the displacement of generation from fossil-fuel thermal plants that would have otherwise delivered to the interconnected grid.

Kartha et al. (2002) stated that, "the crux of the baseline challenge for electricity projects clearly resides in determining the 'avoided generation', or what would have happened without the CDM or other GHG-mitigation project. The fundamental question is whether the *avoided generation* is on the "build margin" (i.e. replacing a facility that would have otherwise been built) and/or the "operating margin" (i.e. affecting the *operation* of current and/or future power plants)."

For PESHP the baseline emission factor is calculated as a combined margin, consisting of the operating margin and the build margin. For the purpose of determining the build margin and the operating margin emission factors, a project electricity system is defined by the spatial extent of the power plants that can be dispatched without significant transmission constraints. Similarly a connected electricity system is defined as one that is connected by transmission lines to the project and in which the power plants can be dispatched without significant transmission constraints.

A.4.4. Public funding of the project activity:

There is no public funding involved on this project.

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

The PESHP project is not part of a larger project activity.

B. Baseline methodology

B.1. Title and reference of the project category applicable to the project activity:

Project title: Pesqueiro Energia Small Hydroelectric Project (PESHP)

Type I- Renewable Energy Projects

B.2. Project category applicable to the project activity:

Category I.D –Renewable electricity generation for a grid

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

The proposed baseline methodology includes an Additionality Tool approved by the Executive Board. This tool considers some important steps necessary to determine if the project activity is additional and demonstrates how the emission reductions would not occur in the absence of the PESHP project activity.

The following are the steps necessary for the assessment of additionality of the PESHP project.

Step 0. Preliminary screening based on the starting date of the project activity:

(a)

The plant construction started in May 2001 and was concluded in December 2002. The small hydropower plant started its commercial operations in January 2003.

As evidence that the starting date of the CDM project activity falls between the predetermined periods there exists resolutions issued by ANEEL including financial statements and other records, which are available under request.

(b)

Three documents confirm that CDM was seriously considered in the decision to proceed with the project activity. They are based on agreements and statements that were negotiated to third parties and are available under request.

The first one is a confidentiality agreement signed between Pesqueiro Energia S.A. and a company that trades carbon credits. Although this contract was signed in November 2002, preliminary conversations about emission reductions started approximately one year earlier before the signature date.

The second document is the PPA signed between Pesqueiro Energia S.A. and Telefônica (former Telecomunicação de São Paulo S.A. - Telesp) in January 2003 where carbon credits rights are mentioned. The parties started discussing the PPA contract before the construction phase.

Prior to all these conversations and formal agreements, at the beginning of 2001, Pesqueiro had started negotiation to hire a CDM advisory company. The project sponsors have kept this informal documentation instead of the enormous uncertainties presented at the time, such as the entry into force of the Protocol, size of the market/price of the CERs, no nominated executive board, lack of approved baseline/monitoring methodologies and so on, the project owners took the risk and seriously considered the incentive from the CDM in the decision to proceed with the activity.

Step 1. Identification of alternatives to the project activity consistent with current laws and regulation

Sub-step 1a. Define alternatives to the project activity:

The alternative to the project activity is the continuation of the current situation, which is the investment of surplus capital in the financial market.

Sub-step 1b. Enforcement of applicable laws and regulations:

2. Not applicable.

3. Not applicable.

4. Non-applicable. Both the project activity and the alternative scenario are in compliance with all regulations.

Step 3. Barrier analysis

3.a. Identify barriers that would prevent the implementation of type of the proposed project activity

To substantiate the barrier analysis a brief overview of the Brazilian electricity market in the last years is first presented.

Until the beginning of the 1990's, the energy sector was composed almost exclusively of state-owned companies. From 1995 on due to the increase in international interest rates and the lack of investment capacity of the State, the government was forced to look for alternatives. The solution recommended was to initiate a privatization process and the deregulation of the market.

The four pillars of the privatization process initiated in 1995 were:

- Building a competition friendly environment, with the gradual elimination of the captive consumer. The option to choose an electricity services supplier which began in 1998 for the largest consumers, and should be available to the entire market by 2006;
- Dismantling of the state monopolies, separating and privatizing the activities of generation, transmission and distribution;
- Allowing free access to the transmission lines, and
- Placing the operation and planning responsibilities to the private sector.

At the same time three entities were created, the Electricity Regulatory Agency, ANEEL set up to develop the legislation and to regulate the market; the National Electric System Operator, ONS, to supervise and control the generation, transmission and operation; and the Wholesale Electricity Market, MAE, to define rules and commercial procedures of the short-term market.

At the end of 2000, after five years of the privatization process, results were modest (Figure 5). Despite high expectations, investments in new generation did not follow the increase in consumption.

The decoupling of GDP (average of 2% increase in the period of 1980 to 2000) from electricity consumption increase (average of 5% increase in the same period) is well known in developing countries, mainly due to the broadening of supply services to new areas and the growing infra-structure. The necessary measures to prevent bottlenecks in services were taken. These include an increase of generation capacity higher than the GDP growth rate and strong investments in energy efficiency. In the Brazilian case, the increase in the installed generation capacity (average of 4% in the same period) did not follow the growth of consumption as can be seen in Figure 6.

Without new installed capacity, the only alternatives were energy efficiency improvements or higher capacity utilization (capacity factor). Regarding energy efficiency, the government established in 1985 PROCEL (the National Electricity Conservation Program). Although the objectives of the program were commendable the results were limited, mainly due to insufficient investment and poorly managed strategies.

The remaining alternative, to increase the capacity factor of the old plants was the most widely used, as can be seen in Figure 7. To understand if such increase in capacity factor brought positive or negative consequences one needs to analyze the availability and price of fuel. In the Brazilian electricity model the primary energy source is water accumulated in the reservoirs. Figure 8 shows what has happened to the levels of "stored energy" in the reservoirs from January 1997 to January 2002. It can be seen that reservoirs which were planned to withstand 5 years of less-than-average rainy seasons almost collapsed after a single season of low rainfall (2000/2001 experienced 74% of historical average rainfall). This situation depicts a very intensive use of the country's hydro resources to support the increase in demand without increase of installed capacity. Under the situation described there was no long-term solution for the problems that finally caused shortages and rationing in 2001.

Aware of the difficulties since the end of the 1990's, the Brazilian government signalized that it was strategically important for the country to increase thermoelectric generation and consequently be less dependent of hydropower. With that in mind the federal government launched in the beginning of the year of 2000 the *Thermoelectric Priority Plan* (*PPT*, "*Plano Prioritário de Termelétricas*", Federal Decree 3,371 of February 24th, 2000, and Ministry of Mines and Energy Directive 43 of February 25th, 2000), originally planning the construction of 47 thermo plants using Bolivian natural gas, totaling 17,500 MW of new installed capacity by December of 2003. During 2001 and the beginning of 2002 the plan was reduced to 40 plants and 13,637 MW to be installed by December 2004 (Federal Law 10,438 of April 26th, 2002, Article 29). As of today, December 2004, 20 plants totaling around 9,700 MW are operational.

During the rationing of 2001 the government also launched the *Emergency Energy Program* with the short-term goal of building 58 small to medium thermal power plants until by end of 2002 (using mainly diesel oil, 76,9 %, and residual fuel oil, 21.1 %), totaling 2,150 MW power capacity (CGE-CBEE, 2002).

It is clear that hydroelectricity is and will continue as the main source for the electricity base load in Brazil. However, most if not all-hydro resources in the South and Southeast of the country have been exploited, and most of the remaining reserves are located in the Amazon basin, far from the industrial and population centers (OECD, 2001). Clearly, new additions to Brazil's electricity power sector are shifting from hydro to natural gas plants (Schaeffer *et al.,* 2000). With discoveries of vast reserves of natural gas in the Santos Basin in 2003 the policy of using natural gas to generate electricity remains a possibility and it will continue to generate interest from private-sector investors in the Brazilian energy sector.

In power since January 2003, the newly elected government decided to fully review the electricity market institutional framework. A new model for the electricity sector was approved by Congress in March 2004. The new regulatory framework for the electricity sector has the following key features (OECD, 2005):

- Electricity demand and supply will be coordinated through a "Pool" Demand to be estimated by the distribution companies, which will have to contract 100 per cent of their projected electricity demand over the following 3 to 5 years. These projections will be submitted to a new institution (*Empresa de Planejamento Energético*, EPE), which will estimate the required expansion in supply capacity to be sold to the distribution companies through the

Pool. The price at which electricity will be traded through the Pool is an average of all long-term contracted prices and will be the same for all distribution companies.

- In parallel to the "regulated" long-term Pool contracts, there will be a "free" market. Although in the future, large consumers (above 10 MW) will be required to give distribution companies a 3-year notice if they wish to switch from the Pool to the free market and a 5-year notice for those moving in the opposite direction a transition period is envisaged during which these conditions will be made more flexible. These measures should reduce market volatility and allow distribution companies to better estimate market size. If actual demand turns out to be higher than projected, distribution companies will have to buy electricity in the free market. In the opposite case, they will sell the excess supply in the free market. Distribution companies will be able to pass on to end consumers the difference between the costs of electricity purchased in the free market and through the Pool if the discrepancy between projected and actual demand is below 5 per cent. If it is above this threshold, the distribution company will bear the excess costs.
- The government opted for a more centralized institutional set-up, reinforcing the role of the Ministry of Mines and Energy in long-term planning. EPE will submit to the Ministry its desired technological portfolio and a list of strategic and non-strategic projects. In turn, the Ministry will submit this list of projects to the National Energy Policy Council (*Conselho Nacional de Política Energética*, CNPE). Once approved by CNPE, the strategic projects will be auctioned on a priority basis through the Pool. Companies can replace the non-strategic projects proposed by EPE, if their proposal offers the same capacity for a lower tariff. Another new institution is a committee (*Comitê de Monitoramento do Setor Elétrico,* CMSE), which will monitor trends in power supply and demand. If any problem is identified, CMSE will propose corrective measures to avoid energy shortages, such as special price conditions for new projects and reserve of generation capacity. The Ministry of Mines and Energy will host and chair this committee. No major further privatizations are expected in the sector.

Although the new model reduces market risk, its ability to encourage private investment in the electricity sector will depend on how the new regulatory framework is implemented. Several challenges are noteworthy in this regard. *First,* the risk of regulatory failure that might arise due to the fact that the government will have a considerable role to play in long-term planning should be avoided by enhancing the Ministry of Mines and Energy's technical capabilities, while insulating the new institutions from political interference. *Second,* rules will need to be designed for the transition from the current to the new model to allow current investments to be rewarded adequately. *Third,* because of its small size, price volatility may increase in the short-term electricity market, in turn bringing about higher investment risk, albeit this risk will be attenuated by the role of large consumers. The high share of hydropower in Brazil's energy mix and uncertainty over rainfall also contribute to higher volatility of the short-term electricity market. *Fourth,* although the new model will require total separation between generation and distribution, regulations for the unbundling of vertically integrated companies still have to be defined. Distribution companies are currently allowed to buy up to 30 per cent of their electricity from their own subsidiaries (self-dealing). *Finally,* the government's policy for the natural gas sector needs to be defined within a specific sectoral framework.

Investment Barrier (Long-term funding)

In order to analyze accurately the investment environment in Brazil, the Brazilian Prime Rate, known, as SELIC rate, as well as the CDI – Interbank Deposit Certificate, which is the measure of value of value in the short-term credit market, need to be taken into account. Real interest rates have been extraordinarily high since the Real plan stabilized inflation in 1994.

As a consequence of the long period of inflation, the Brazilian currency experienced high volatility coupled with strong devaluation, effectively precluding commercial banks from providing any long-term debt financing to local companies. The lack of a long-term debt market caused a severe negative impact on the financing of energy projects in Brazil. Real interest rates have been extraordinarily high since the Real plan stabilized inflation in 1994.

Interest rates for local currency financing are significantly higher than US Dollar rates. The National Development Bank – BNDES is the only supplier of long-term loans. Debt financing from BNDES are made primarily through commercial banks. The credit market is dominated by shorter maturities (90-days to 01-year) and long-term credit lines are available only to the strongest corporate borrowers and for special government initiatives. Credit is restricted to the short-term in Brazil or the long-term in dollars offshore.

Financial domestic markets with maturity of one year or greater practically do not exist in Brazil. Experience has shown that in moments of financial stress the duration of savings instruments contracted drops to levels close to one day with a massive concentration in overnight banking deposits. Savers do not hold long-term financial contracts due to the inability to price-in the uncertainty involved in the preservation of purchasing power value (Arida et al., 2004).

The lack of local long-term financing results from the reluctance of creditors and savers to lengthen the term of their investments. It has made savers opt for the most liquid investments and to place their money in short-term government bonds instead of investing in long-term opportunities that could finance infrastructure projects.

The most liquid government bond is the LFT (floating rate bonds based on the daily Central Bank reference rate). As of January 2004, 51.1% of the domestic federal debt was in LFTs and had duration of one day. This bond rate is almost the same as the CDI - Interbank Deposit Certificate rate that is influenced by the SELIC rate, defined by COPOM[4].

The SELIC Rate has been very volatile ranging from a minimum of 15% p.a. in January 2001 to a maximum of 45% p.a. in March 1999.

Due to the above, the only alternative available to project developers in Brazil is the National Development Bank (BNDES).

Pesqueiro Energia did not have access to BNDES credit lines. The sponsors, looking for the opportunities within the Clean Development Mechanism, fully funded the project on an equity basis. Therefore, the lack of financing alternatives is a barrier for the project.

The stockholders provided the financing, and as a result, the project's capital structure is 100% equity.

Investment Barrier (WACC)

As described above, the access of long-term funding for renewable energy projects is difficult. The following is a specific analysis which demonstrates that the high cost of capital in Brazil is a barrier for projects to be developed on an equity basis.

The rate used to discount the business cash flow is also known as WACC[5] and converts the future cash flow into a present value to all investors, considering that both creditors and shareholders expect

[4] COPOM – *Comitê de Politica Monetária* (Monetary Policy Commitee)
[5] Weighted-Average Cost of Capital

compensation towards the opportunity cost of investing resources in a specific business instead of investing such resources in another business of equivalent risk.

The basic principle to be followed when calculating the WACC is consistency with the valuation method and with the definition of the discounted cash flow. The formula used to estimate the company's WACC after taxes is:

WACC = [(Kd x (1-t) x Pd)+(Ke x (1-Pd))]

Where:

WACC= Weighted-average cost of capital
Kd= Cost of Debt (third-party capital)
t = Marginal corporate income tax
Pd= Debt as a percentage of total capitalization
Ke= Cost of Equity (own capital)

Considering the PESHP project was financed solely with sponsor capital, the non-leveraged model is used to calculate the firm's WACC. Therefore, cost of debt is relevant to our analysis and Kd is set to zero.

Equity markets in Brazil are relatively illiquid and concentrated, therefore to estimate the Cost of Equity (Ke), parameters observed in global financial markets were used allowing the application of the CAPM model. Given these assumptions, the cost of capital in Brazil should be close to a global cost of capital adjusted for local inflation and capital structure. It should be noted that as far as calculating the inflation differential an estimate of the compounded difference between the local inflation rate and the US inflation rate over ten years was used. Also, for calculation purposes, a Beta which measures systemic equity risk within the company's industry was used, typical of the environmental services sector. Thus, in order to calculate Pesqueiro Energia' cost of equity the following parameters[6] were used:

Cost of Equity – Pesqueiro Energia		
Yield on Brazilian Sovereign Euro Bond	**Plus**	15%p.a.
10-year BB Credit risk premium over US Treasuries	**Minus**	4%p.a.
10-year US/Brazilian inflation differential	**Plus**	6%p.a.
International Market Equity Risk Premium	**Plus**	5%p.a.
Adjustment of Market Equity Risk with Beta of 0.4	**Minus**	2%p.a.
Pesqueiro Cost of Equity with Brazil Country Risk		20%p.a.

Applying Ke=20% to the formula below:

WACC = [(Not Applicable x 0%) + (20%p.a. x 100%)] = 20%p.a.

[6] Copeland et al.; Measuring and Managing the Value of Companies; Third Edition.

Thus Pesqueiro's Weighted Average Cost of Capital is equal to 20% p.a.

Therefore, the high WACC is a barrier to investments in renewable energy projects like PESHP that has an IRR – Internal Rate of Return of 17% p.a. This value was obtained through a Free Cash Flow analysis developed by the project developers, which is available upon request,

Institutional Barrier

As described above, since 1995 government electricity market policies have been continuously changing in Brazil. Too many laws and regulations were created to try to organize and to provide incentives for new investments in the energy sector. The results of such regulatory instability were the contrary to what was trying to be achieved. During the rationing period electricity prices surpassed BRL 600/MWh (around USD 200/MWh) and the forecasted marginal price of the new energy reached levels of BRL 120 – 150/MWh (around USD 45). In the middle of 2004 the average price was bellow BRL 50/MWh (less than USD 20/MWh). The high volatility of the electricity price in Brazil indicates an inconsistency in government policies and there is no guarantee that the project will operate in a secure regulatory energy market.

Prevailing Business Practice

In 2001, Eletrobrás, in partnership with BNDES, launched the PCH-COM program (PCH- from the Portuguese - Small Hydro Plant) that had as its main goal to support and encourage the construction of Small Hydro Plants. This program consisted in the financing of the project by the BNDES and the commercialization of the energy by Eletrobrás. The operation of the program consisted in an analysis of the project by both BNDES and Eletrobras. In case the project was approved there would be two contracts to be signed: one with the BNDES and the other, a PPA (Power Purchase Agreement) with Eletrobrás.

After several meetings with BNDES and Eletrobras, Pesqueiro Energia S/A decided to join the program. Pesqueiro was then required to post the PPA with Eletrobras as collateral. In addition, the program requested guarantees, performance bonds and insurance policies in excess of shareholder's equity. Pesqueiro was not able to meet BNDES requirements and decided to drop out of the program. The prevailing business practice in Brazil as far as obtaining financing and financial guarantees to project is a barrier to investment in renewable energy projects.

Sub-step 3b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives:

As described above, the main alternative to the project activity is to continue with the status quo. The project sponsor could invest their resources in different financial market investments. Therefore the barriers above have not affected the investment in other opportunities. To the contrary Brazilian interest rates, which represent a barrier for the project activity, is a viable investment alternative

Step 4. Common practice analysis:

One of the points to be considered when analyzing a small hydro project investment is the possibility to participate the Proinfa Federal Government Program. Although some projects started construction independently from Proinfa, the program is considered one of the more viable financing alternatives for these projects, which will provide long-term PPAs and special financing conditions. PESHP is not participating in the program and is addressing the market risk as it structures its projects.

Both process of negotiating a PPA with utility companies and obtaining funding from BNDES have proved to be very cumbersome. BNDES also requires excessive guarantees in order to provide financing. Other risks and barriers are related to the operational and technical issues associated with small hydros, including their capability to comply with the PPA contract and the potential non-performance penalties.

Regardless of the risks and barriers mentioned above, the main reason for the reduced number of similar project activities is the economic cost. Project feasibility requires a PPA contract with a utility company, but the utilities do not have the incentives or motivation to buy electricity generated by small hydro projects.

Because of the reasons mentioned above, only 1.3% of installed capacity comes from small hydro sources (1.2 GW out of a total of 88.7 GW). Also, from the 6,934 MW under construction in the country, only 403 MW are small hydro. In 2004, only 9 small-hydro projects, a total of just 5.22 MW, were authorized by the regulatory agency[7]. Many other projects are still under development, waiting for better investment opportunities. Most of the developers which funded their projects outside of Proinfa have taken CDM as decisive factor for completing their projects. Therefore, to the best of our knowledge the vast majority of similar projects being developed in the country are participating in the Proinfa Program and those not are participating in the CDM. Additionally, the Brazilian government has stated that the projects under the Proinfa Program will also be eligible to participate in the CDM. The legislation which created Proinfa took into account possible revenues from the CDM in order to proceed with the program.

Step 5 – Impact of CDM Registration

By definition[8], small hydro in Brazil is a hydro plant with installed capacity greater than 1 MW and up to 30 MW, and with reservoir area of less or equal to 3 km². Generally, it consists of a run-of-the-river hydro plant, which has a minimum environmental impact.

This is not the business-as-usual scenario in a country where large hydro and thermal fossil fuel projects are preferable. With the financial benefit derived from the CERs, it is anticipated that other project developers would benefit from this new source of revenue and would then decide to develop such projects. An increase of approximately 100 to 200 basis points, derived form CERs would be an important factor in determination to start such project.

CDM has made it possible for some investors to set up small hydro plants and sell electricity to the grid. The registration of the proposed project activity will have a strong impact in paving the way for similar projects to be implemented in Brazil.

B.4. Description of the project boundary for the project activity:

PESHP: The project boundaries are defined by the emissions targeted or directly affected by the project activities, construction and operation. It encompasses the physical, geographical site of the hydropower generation source, which is represented by the Jaguariaíva River basin close to the power plant facility and the interconnected grid.

Brazil is a large country and is divided in five macro-geographical regions, North, Northeast, Southeast, South and Midwest. The majority of the population is concentrated in the regions South, Southeast and Northeast. Thus the energy generation and, consequently, the transmission are concentrated in three subsystems. The energy expansion has concentrated in three specific areas:

[7] ANEEL – Agência Nacional de Energia Elétrica (National Power Regulatory Agency)
[8] As defined by ANEEL Resolution n. 394, December 4th, 1998.

- Northeast: The electricity for this region is basically supplied by the São Francisco River. There are seven hydro power plants at the river with total installed capacity around 10.5 GW.
- South/Southeast/Midwest: The majority of the electricity generated in the country is concentrated in this subsystem. These regions also concentrate 70% of the GDP generation in Brazil. There are more than 50 hydro power plants generating electricity for this subsystem.
- North : 80% of the Northern region is supplied by diesel. However, in the city of Belém, capital of the state of Pará where the mining and aluminum industries are located, electricity is supplied by Tucuruí, the second biggest hydro plant in Brazil.

The boundaries of the subsystems are defined by the capacity of transmission. The transmission lines between the subsystems have a limited capacity and the exchange of electricity between those subsystems is difficult. The lack of transmission lines forces the concentration of the electricity generated in each own subsystem. Thus the South-Southeast-Midwest interconnected subsystem of the Brazilian grid where the project activity is located is considered as a boundary.

Part of the electricity consumed in Brazil is imported from other countries. Argentina, Uruguay and Paraguay supply a very small amount of the electricity. In 2003 around 0.1% of the electricity was imported from these countries. In 2004 Brazil exported electricity to Argentina which was experiencing a shortage period. The energy imported from other counties does not affect the boundary of the project and the baseline calculation.

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

B.5.1 Specify the baseline for the proposed project activity using a methodology specified in the applicable project category for small-scale CDM project activities contained in appendix B of the simplified M&P for small-scale CDM project activities:

According to the simplified M&P for small-scale CDM, there are two options that can be applied in the selected project category.

"The baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO2equ/kWh) calculated in a transparent and conservative manner:

(a) The average of the "approximate operating margin" and the "build margin", where:

  (i) The "approximate operating margin" is the weighted average emissions (in kg CO2equ/kWh) of all generating sources serving the system, excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation;

  (ii) The "build margin" is the weighted average emissions (in kg CO2equ/kWh) of recent capacity additions to the system, which capacity additions are defined as the greater (in MWh) of most recent 20% of existing plants or the 5 most recent plants.";

or,

(b) The weighted average emissions (in kg CO2equ/kWh) of the current generation mix.

The option chosen in this project is option (a). This choice is due to the fact that, in Brazil, even though most of the energy produced in the country comes from hydroelectric power, most of these low cost investments in hydro electrics are exhausted. Therefore, the possibility of investments in non-renewable sources arises, such as thermoelectric power plants.

As thermal plants use fossil, these companies end up having higher operational costs than hydro plants. As a result, they are likely to be displaced by any hydro added to the grid.

B.5.2 Date of completing the final draft of this baseline section *(DD/MM/YYYY):*

21/12/2004

B.5.3 Name of person/entity determining the baseline:

Mr. Ricardo Esparta, director of Ecoinvest.

Ecoinvest Assessoria Ltda.
Rua Padre João Manoel, 222 Cj-36
CEP – 01411-000
São Paulo – SP
Brazil

C. Duration of the project activity and crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the project activity:

27/01/2003

C.1.2. Expected operational lifetime of the project activity:

25 y – 0m

C.2. Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period *(DD/MM/YYYY)*:

27/01/2003

C.2.1.2. Length of the first crediting period:

7y-0m

C.2.2. Fixed crediting period:

C.2.2.1. Starting date *(DD/MM/YYYY):*

Not applicable

C.2.2.2. Length (max 10 years):

Not applicable

D. Monitoring methodology and plan

D.1. Name and reference of approved methodology applied to the project activity

According to option (a) of Type I, Category D of CDM small-scale project activity categories contained in Appendix B of the simplified M&P for CDM small-scale project activity, monitoring shall consist of metering the electricity generated by the renewable technology.

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

This Monitoring Plan has been chosen as it is suggested in the option (a) of Type I, Category D of CDM small-scale project activity categories contained in Appendix B of the simplified M&P for CDM small-scale project activity and applies to electricity capacity additions from small-scale run-of-river hydro power plants.

D.3 Data to be monitored:

ID number	Data type	Data variable	Data unit	Measured (m), calculated (c) or 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
1	Electricity Generation	Electricity generation of the Project delivered to grid	MWh	M	15 minutes measurement and Monthly Recording	100%	Electronic and paper	During the credit period and two years after	The electricity delivered to the grids monitored such by the project (seller) as the energy buyer. Energy metering connected to the grid and Receipt of Sales
2	CO_2 emission factor	CO_2 emission factor of the grid d	tCO_2/MWh	C	At the validation	0%	Electronic	During the credit period and two years	Data will be archived according to internal procedures.

								after	
3	CO2 Operating Margin.	CO2 Operating Margin emission factor of the grid	tCO_2/MWh	C	At the validation	0%	Electronic	During the credit period and two years after	
4	CO2 Build Margin	CO2 Build Margin emission factor of the grid	tCO_2/MWh	C	At the validation	0%	Electronic	During the credit period and two years after	

D.4 Name of person/entity determining the monitoring methodology:

Mr. Ricardo Esparta, director of Ecoinvest.

Ecoinvest Assessoria Ltda.
Rua Padre João Manoel, 222 Cj-36
CEP – 01411-000
São Paulo – SP
Brazil

E. Calculation of GHG emission reductions by sources

E.1 Formulae used:

E.1.1 Selected formulae as provided in appendix B:

According to the baseline methodology activities contained in appendix B of the simplified M&P for small-scale CDM project activities, as is the case of PESHP, emission reductions are those that result from the application of the formula mentioned in item B.5.1. therefore, the present project activity' greenhouse gas emissions are zero.

E.1.2 Description of formulae when not 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:

Not applicable (GHG emissions by the project activity are zero).

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:

Not applicable (GHG emissions by the project activity are zero).

E.1.2.3 The sum of E.1.2.1 and E.1.2.2 represents the project activity emissions:

Not applicable (GHG emissions by the project activity are zero).

E.1.2.4 Describe the formulae used to estimate the anthropogenic emissions by sources of GHG's 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:

As explained in item B.5.1, the baseline emission factor will be calculated as the average of the "approximate operating" margin and the "build margin", where:

(b) The average of the "approximate operating margin" and the "build margin", where:

(i) The "approximate operating margin" emission factor ($EF_{OM,y}$) is the weighted average emissions (in kg CO2equ/MWh) of all generating sources serving the system, excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. Using the notation from approved methodology, ACM0002[9],

$$EF_{OM,y} = \frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}} \qquad \textbf{Equation 1}$$

Where:

- $\sum_{i,j} F_{i,j,y}$ is the amount of fuel *i* (in mass or volume unit) consumed by relevant power sources *j* in year(s) *y*,
- $COEF_{i,j}$ is the CO_{2e} coefficient of fuel *i* (tCO_{2e}/mass or volume unit of the fuel), taking into account the carbon dioxide equivalent emission potential of the fuels used by relevant power sources *j* and the percent oxidation of the fuel in year(s) *y* and,
- $\sum_{j} GEN_{j,y}$ is the electricity (MWh) delivered to the grid by source *j*,

The CO_2e coefficient $COEF_i$ is obtained as,

$$COEF_{i,j} = NCV_i \cdot EF_{CO2,i} \cdot OXID_i \qquad \textbf{Equation 2}$$

Where:

- NCV_i is the net calorific value (energy content) per mass or volume unit of fuel *i*,
- $OXID_i$ is the oxidation factor of the fuel *i*,
- $EF_{CO2,i}$ is CO_2e emission factor per unit of energy of the fuel *i*,

(ii) The "build margin" emission factor ($EF_{BM,y}$) is the weighted average emissions (in kg CO2equ/MWh) of recent capacity additions to the system, which capacity additions are defined as the greater (in MWh) of most recent 20% of existing plants or the 5 most recent plants,

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \cdot COEF_{i,m}}{\sum_{m} GEN_{m,y}} \qquad \textbf{Equation 3}$$

Where $F_{i,m,y}$, $COEF_{i,m}$ and $GEN_{m,y}$ are analogous to the variables described above for the operating margin for plants *m* (sample group *m* defined in (ii)), based on the most recent information available on plants already built.

The baseline emission factor EF_y is the average of the operating margin factor ($EF_{OM,y}$) and the build margin factor ($EF_{BM,y}$),

$$EF_y = 0.5 \cdot EF_{OM,y} + 0.5 \cdot EF_{BM,y} \qquad \textbf{Equation 4}$$

The national dispatch center (Operador Nacional do Sistema Elétrico, Centro Nacional de Operação do Sistema, Acompanhamento Diário da Operação do Sistema Iterligado Nacional, daily

[9] **ACM0002 (2004).** *Approved Consolidated Baseline Methodology 0002 – Consolidated Methodology for grid-connected electricity generation from renewable sources.* UNFCCC, CDM Executive Board 15th Meeting Report, 3 September 2004, Annex 2.

reports from Jan. 1, 2001 to Dec. 31, 2003) supplied the raw dispatch data for the whole Brazilian interconnected grid. The following data sources were relevant for the calculation of the baseline:

- The Brazilian electricity system has been historically divided into two subsystems: the North-Northeast (N-NE) and the South-Southeast-Midwest (S-SE-CO). This is due mainly to the historical evolution of the physical system, which was naturally developed nearby the biggest consuming centers of the country.

  The natural evolution of both systems is increasingly showing that integration is to happen in the future. In 1998, the Brazilian government was announcing the first leg of the interconnection line between S-SE-CO and N-NE. With investments of around US$700 million, the connection had the main purpose, in the governments view, at least, to help solve energy imbalances in the country: the S-SE-CO region could supply the N-NE in case it was necessary and vice-versa.

  Nevertheless, even after the interconnection had been established, technical papers still divided the Brazilian system in two (Bosi, 2000)[10]:

  "… where the Brazilian Electricity System is divided into three separate subsystems:

(i) The South/Southeas/Midwest Interconnected System;

(ii) The North/Northeast Interconnected System; and

(iii) The Isolated Systems (which represent 300 locations that are electrically isolated from the interconnected systems)"

  Moreover, Bosi (2000) gives a strong argumentation in favor of having so-called *multi-project baselines*:

  "For large countries with different circumstances within their borders and different power grids based in these different regions, multi-project baselines in the electricity sector may need to be disaggregated below the country-level in order to provide a credible representation of 'what would have happened otherwise'".

  Finally, one has to take into account that even though the systems today are connected, the energy flow between N-NE and S-SE-CO is heavily limited by the transmission lines capacity. Therefore, only a fraction of the total energy generated in both subsystems is sent one way or another. It is natural that this fraction may change its direction and magnitude (up to the transmission line's capacity) depending on the hydrological patterns, climate and other uncontrolled factors. But it is not supposed to represent a significant amount of each subsystem's electricity demand. It has also to be considered that only in 2004 the interconnection between SE and NE was concluded, i.e., if project proponents are to be coherent with the generation database they have available as of the time of the PDD submission for validation, a situation where the electricity flow between the subsystems was even more restricted is to be considered.

  The Brazilian electricity system nowadays comprises of around 91,3 (91.3) GW of installed capacity, in a total of 1.420 (1,420) electricity generation enterprises. From those, nearly 70% are hydropower plants, around 10% are natural gas-fired power plants, 5,3% (5.3%) are diesel and fuel oil plants, 3,1% (3.1) are biomass sources (sugarcane bagasse, black liquor, wood, rice straw and biogas), 2% are nuclear plants, 1,4% (1.4) are coal plants, and there are also 8,1 (8.1) GW of installed capacity in neighboring countries (Argentina, Uruguay, Venezuela and Paraguay) that may dispatch electricity to the Brazilian grid. (http://www.aneel.gov.br/aplicacoes/capacidadebrasil/OperacaoCapacidadeBrasil.asp). This

[10] Bosi, M. *An Initial View on Methodologies for Emission Baselines: Electricity Generation Case Study*. International Energy Agency. Paris, 2000.

latter capacity is in fact comprised by mainly 6,3 GW (6.3) of the Paraguayan part of Itaipu Binacional, a hydropower plant operated by both Brazil and Paraguay, but whose energy almost entirely is sent to the Brazilian grid.

The Small Scale Approved Methodology I.D asks project proponents to account for "all generating sources serving the system". In that way, when applying this methodology, project proponents in Brazil should search for, and research, all power plants serving the Brazilian system.

In fact, information on such generating sources is not publicly available in Brazil. The national dispatch center, ONS – *Operador Nacional do Sistema* – argues that dispatching information is strategic to the power agents and therefore cannot be made available. On the other hand, ANEEL, the electricity agency, provides information on power capacity and other legal matters on the electricity sector, but no dispatch information can be got through this entity.

In that regard, project proponents looked for a plausible solution in order to be able to calculate the emission factor in Brazil in the most accurate way. Since real dispatch data is necessary after all, the ONS was contacted, in order to let participants know until which degree of detail information could be provided. After several months of talks, plants' daily dispatch information was made available for years 2001, 2002 and 2003.

Project proponents, discussing the feasibility of using such data, concluded it was the most proper information to be considered when determining the emission factor for the Brazilian grid. According to ANEEL, in fact, ONS centralized dispatched plants accounted for 75,547 MW of installed capacity by 31/12/2004, out of the total 98,848.5 MW installed in Brazil by the same date (http://www.aneel.gov.br/arquivos/PDF/Resumo_Gráficos_mai_2005.pdf), which includes capacity available in neighboring countries to export to Brazil and emergency plants, that are dispatched only during times of electricity constraints in the system. Therefore, even though the emission factor calculation is carried out without considering all generating sources serving the system, about 76,4% (76.4%) of the installed capacity serving Brazil is taken into account, which is a fair amount if one looks at the difficulty in getting dispatch information in Brazil. Moreover, the remaining 23,6% (23.6%) are plants that do not have their dispatch coordinated by ONS, since: either they operate based on power purchase agreements which are not under control of the dispatch authority; or they are located in non-interconnected systems to which ONS has no access. In that way, this portion is not likely to be affected by the CDM projects, and this is another reason for not taking them into account when determining the emission factor.

- The amount of fuel consumed by relevant fossil-fuel-fired plants, are the ones collected in a research made by the International Energy Agency (Bosi, M., A. Laurence, P. Maldonado, R. Schaeffer, A. F. Simoes, H. Winkler and J.-M. Lukamba. Road testing baselines for greenhouse gas mitigation projects in the electric power sector. OECD and IEA information paper, October 2002).
- The emission coefficients of each fuel are the ones indicated by the IPCC (Intergovernmental Panel on Climate Change. Revised 1996 Guidelines for National Greenhouse Gas Inventories)

Using the above mentioned data, the numbers in Table 3 and Table 1 arise from the calculation of the baseline and the amount of emission reduction over the chosen crediting period.

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:

The emission reductions by the project activity (ER_y) during a given year y are the product of the baseline emissions factor (EF_y, in tCO_2e/MWh) times the electricity supplied by the project to the grid (EG_y, in MWh), as follows:

$$ER_y = EF_y \cdot EG_y$$ **Equation 5**

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

Considering a baseline of 0.5211 tCO_2e/MWh, the implementation of PESHP project connected to the Brazilian interconnected power grid will generate an estimated annual reduction of 42,179 tCO_2e, and a total reduction of 291,434 tCO_2e for the first 07 years crediting period. Given the project have started in January 27, 2003, the first year contribution would sum 38,359 tCO_2-eq.

Facility	PCH Pesqueiro			
Installed power (MW)	12			
Capacity factor	0,77			
baseline (tCO2/MWh)	**0,5211**			
	Expected Generated energy (MWh)	**tCO2 abated**	**Total tCO2 abated (acummulated)**	
2003	73.612	38.359	38.359	1st year
2004	80.942	42.179	80.538	2nd
2005	80.942	42.179	122.717	3rd
2006	80.942	42.179	164.896	4th
2007	80.942	42.179	207.076	5th
2008	80.942	42.179	249.255	6th
2009	**80.942**	**42.179**	**291.434**	**7th year**
2010	80.942	42.179	333.613	8th
2011	80.942	42.179	375.792	9th
2012	80.942	42.179	417.971	10th
2013	80.942	42.179	460.150	11th
2014	80.942	42.179	502.329	12th
2015	80.942	42.179	544.508	13th
2016	**80.942**	**42.179**	**586.687**	**14th year**
2017	80.942	42.179	628.866	15th
2018	80.942	42.179	671.045	16th
2019	80.942	42.179	713.225	17th
2020	80.942	42.179	755.404	18th
2021	80.942	42.179	797.583	19th
2022	80.942	42.179	839.762	20th
2023	**80.942**	**42.179**	**881.941**	**21st year**

Table 1 – Estimated PESHP project emissions reductions

F. Environmental impacts

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

The proponent of any project that involves the construction, installation, expansion, and operation of any polluting or potentially polluting activity or any activity capable of causing environmental degradation is required to secure a series of permits from the respective state environmental agency. In addition, any such activity requires the preparation of an environmental assessment report, prior to obtaining construction and operation permits. Three types of permits are required. The first is the preliminary permit (*Licenca Prévia* or L.P.) issued during the planning phase of the project and which contains basic requirements to be complied with during the construction, and operating stages. The second is the construction permit (*Licença de Instalação* or L.I.) and, the final one is the operating permit (*Licenca de Operação* or L.O.).

Pesqueiro Energia S/A has the authorization issued by ANEEL to operate as an independent power producer (resolution nº476 – 06/12/2000) and has also the exploitation right of the small hydro Pesqueiro.

The preparation of an Environmental Impact Assessment is compulsory to obtain the construction and the operation licenses. In the process a report containing an investigation of the following aspects was prepared:

- Impacts to climate and air quality.
- Geological and soil impacts.
- Hydrological impacts (surface and groundwater).
- Impacts to the flora and animal life.
- Socio-economical (necessary infra-structure, legal and institutional, etc.).

The project has the necessary environmental and construction licenses. The operating permit/license were issued by the state environmental institute, IAP (Instituto Ambiental do Paraná), in March 07, 2005. L.O. nº 6786 (Figure 11).

G. Stakeholders' comments

G.1. Brief description of the process by which comments by local stakeholders have been invited and compiled:

Public discussion with local stakeholders is mandatory for obtaining the environmental construction and operating licenses, and once the project was awarded with those mandatory licenses (item F above), it is clear the project has gone through the stakeholder comments process. The legislation also requests the announcement of the issuance of the licenses (LP, LI and LO) in the local state official journal (*Diário Oficial do Estado*) and in the regional newspaper to make the process public and allow public information and opinion.

The municipality of Jaguariaíva, which is where the project is located, and other neighboring municipalities along the Jaguariaíva River, which are the ones most impacted by the project, participated on the public hearing process.

Besides the stakeholder comments, the project is a small run-of-the river power plant, so there is very minor disruption to the local environment and there is no disruption to local communities. In addition to the mandatory requirements, the project sponsor is working with local communities on environmental education projects, reforestation of degraded areas, regular water quality assessment, support for environmental parks, hiring of local manpower, erosion control, and support for community agriculture. No objections were raised regarding the projects.

G.2. Summary of the comments received:

Pesqueiro Energia did not receive any comments on the project.

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

No comments were received. The project was developed as planned and following the requests made by IAP, the state environmental agency.

Annex 1. Contact information on participants in the project activity

Organization:	Pesqueiro Energia S. A.
Street/P.O. Box:	Estrada Geral Ponta Grossa- Itararé
Building:	
City:	Jaguariaíva
State/Region:	Paraná
Postfix/ZIP:	
Country:	Brazil
Telephone:	+55 (43) 535-6764
FAX:	
E-Mail:	pesqueiro@eletrorural.com.br
URL:	
Represented by:	
Title:	Economic Coordinator
Salutation:	Mr.
Last name:	Oliveira
Middle name:	César
First name:	Rosmir
Department:	
Mobile:	
Direct fax:	
Direct tel.:	+55 (42) 2341134
Personal e-mail:	rosmir@eletrorural.com.br

Pesqueiro Energia S. A. is owned by three cooperatives:

- ELETRORURAL – Cooperativa de Eletrificação Rural Castrolanda Ltda. (30% of the project)
  - Address: Rua das Flores, 328. Cx.Postal – 294
  - City/state/country: Castrolanda, Castro – PR, Brazil.
  - Zip: 84.196-200
  - E-mail/URL: rosmir@eletrorural.com.br / http://www.castrolanda.com.br/
- CERAL – Cooperativa de Eletrificação Rural de Arapoti Ltda. (30%)
  - Address: R. Saladino de Castro, 835
  - City/state/country: Arapoti - PR, Brazil
- CERIPA – Coop. Eletrificação Rural de Itaí-Paranapanema-Avaré Ltda. (40%)

- Address: R. Manoel Jardim Garcia, 1177
- City/state/country: Itaí - SP, Brazil
- E-mail/URL: http://www.ceripa.com.br/

Annex 2. Information regarding public funding

No public funding was and will be used in the present project.

Annex 3. Figures

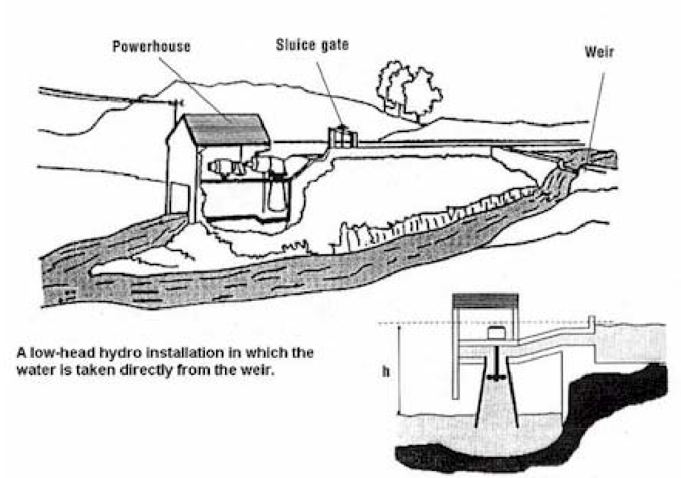

Figure 1 – Schematic view of a run-of-river power plan

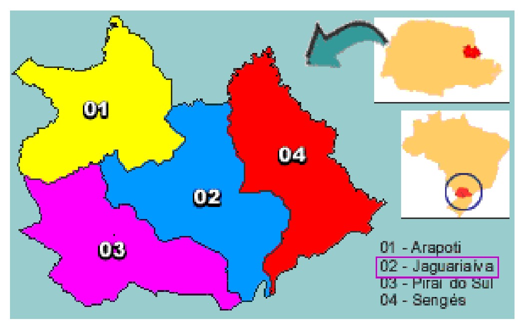

Figure 2 - Political division of Brazil showing the Paraná State and the city of Jaguariaíva (Sources: http://www.citybrazil.com.br/).

Figure 3 – Major Brazilian river basins (Source: http://www.portalbrasil.net/)

Figure 4 - Francis Turbine (Source: Alstom, http://www.alstom.com.br/)

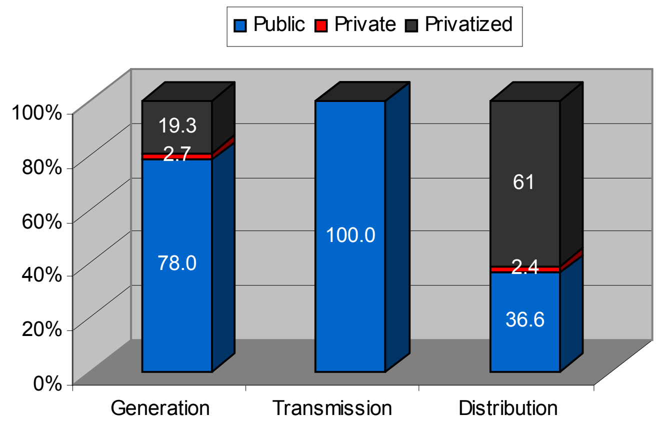

Figure 5 - Participation of private capital in the Brazilian electricity market in December 2000 (Source: BNDES, 2000)

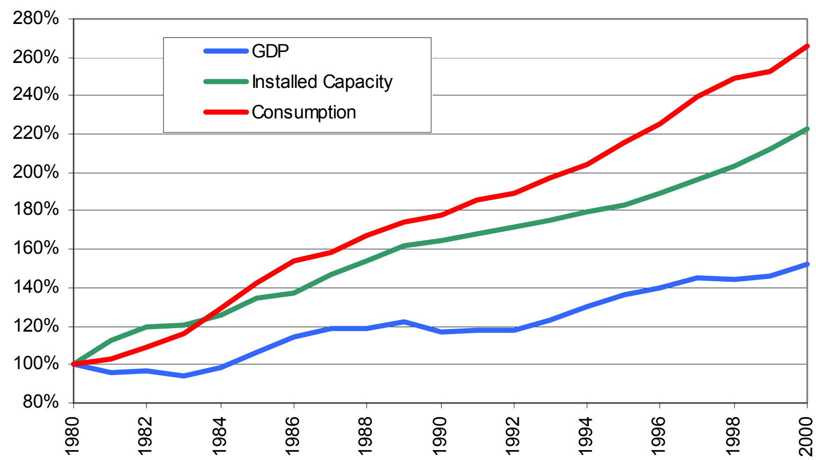

Figure 6 - Cumulated variation of GDP, electricity supply (installed capacity) and demand (consumption) (Source: Eletrobrás, http://www.eletrobras.gov.br; IBGE, http://www.ibge.gov.br/)

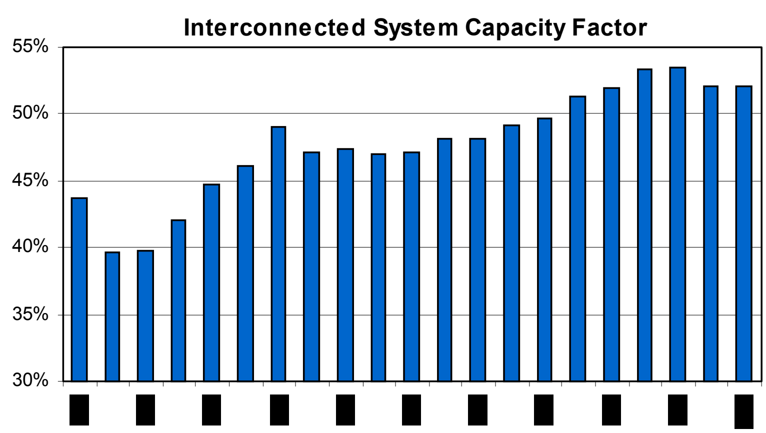

Figure 7 - Evolution of the rate of generated energy to installed capacity (Source: Eletrobrás, http://www.eletrobras.gov.br/).

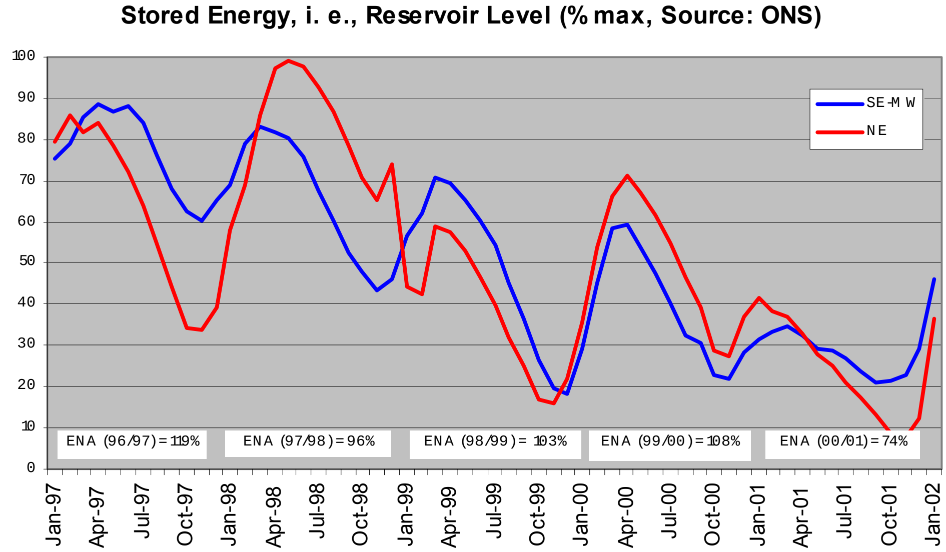

Figure 8 - Evolution of the water stored capacity for the Southeast/Midwest (SE-MW) and Northeast (NE) interconnected subsystems and intensity of precipitation in the rainy season (ENA) in the southeast region compared to the historic average (Source: ONS, http://www.ons.org.br/)

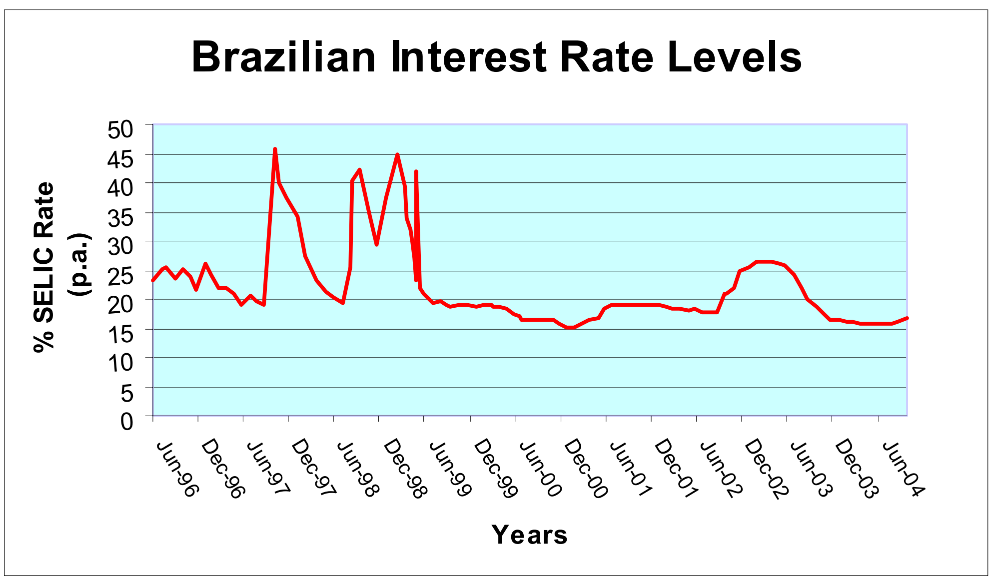

Figure 9- SELIC rate (Source: Banco Central do Brasil, http:/www.bcb.gov.br/)

Horizonte 2006

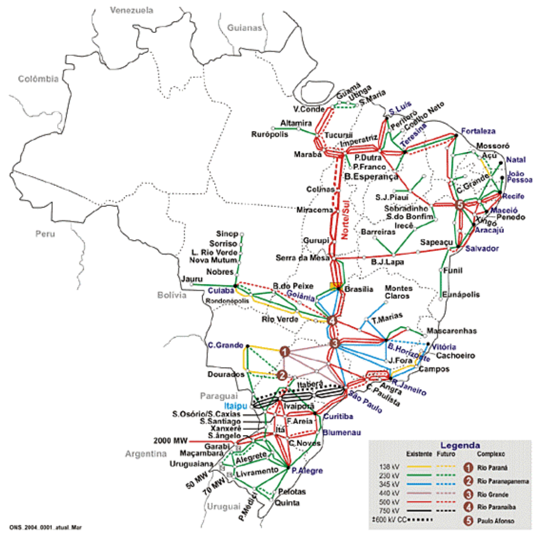

Figure 10 - Brazilian Interconnected System (Source: ONS, http://www.ons.org.br/)

GOVERNO DO PARANÁ
Secretaria do Estado do Meio Ambiente e Recursos Hídricos

IAP — Instituto Ambiental do Paraná
Diretoria de Controle de Recursos Ambientais

Licença de Operação

Nº 6786
Validade 7/3/2009
Protocolo 59691279

O Instituto Ambiental do Paraná - IAP, com base na legislação ambiental e demais normas pertinentes, e tendo em vista o contido no expediente protocolado sob o nº 59691279, expede a presente Licença de Operação à:

01 IDENTIFICAÇAO DO AUTORIZADO

Razão Social - Pessoa Jurídica / Nome - Pessoa Física
PESQUEIRO ENERGIA S/A

C.G.C. - Pessoa Jurídica / C.P.F. - Pessoa Física	Inscrição Estadual - Pessoa Jurídica / R.G. - Pessoa Física
04019594000133	9023815890

Endereço
Rua das Flores, 382

Bairro	Município	UF	Cep
Colonia Castrolanda	Castro	PR	84196200

02 IDENTIFICAÇÃO DO EMPREENDIMENTO

Empreendimento
Pequena Central Hidrelétrica - PCH PESQUEIRO

Tipo de empreendimento/atividade
PEQUENA CENTRAL HIDRELÉTRICA RENOVAÇAO DE LO

Endereço	Bairro
Estrada Geral Ponta Grossa - Itararé	Pesqueiro

Município	Cep
Jaguariaíva	84200000

Corpo Hídrico do Entorno	Bacia Hidrográfica
Rio Jaguariaiva	Itararé

Destino do Esgoto Sanitário	Destino do Efluente Final
****************	****************

03 REQUISITOS DO LICENCIAMENTO DE OPERAÇÃO

- Súmula desta licença deverá ser publicada no Diário Oficial do Estado e em jornal de grande circulação local ou regional, no prazo máximo de 30 (trinta) dias, nos termos da Resolução CONAMA nº 006/86.
- Esta LICENÇA DE OPERAÇÃO tem a validade acima mencionada, devendo a sua renovação ser solicitada ao IAP com antecedência mínima de 120 (cento e vinte) dias.
- Quaisquer alterações ou expansões nos processos de produção ou volumes produzidos pela indústria e alterações ou expansões no empreendimento, deverão ser licenciados pelo IAP.
- Esta LICENÇA DE OPERAÇÃO deverá ser afixada em local visível

Detalhamento dos Requisitos de Licenciamento
Esta Licença trata-se de Renovação de Licença Ambiental de Operação.
1- Executar e manter as condições vegetativas nativas (matas ciliares), no entorno do lago e geratriz do curso d´água contribuinte;
2- Atentar a legislação CONAMA nº 302 e 303/02, fato ser área rural (100 metros);
3- Implantar sinalização vertical e horizontal com indicativo da PCH, (vias internas e externas, zonas de riscos, restritivas e permessíveis);
4- Recomposição de áreas em processos erodíveis;
5- Manter e operar os Programas Ambientais apresentados no 1º relatório (abril de 2004);
6- Deverá apresentar relatórios semestrais dos programas e medidas ambientais relativas a operação da PCH.

Impressa: 07/03/2005 11:05:20 Página:1 de 2

Figure 11 – PESHP operation license

Annex 4. Tables

Turbines	
Type	Simple Francis
Quantity	2
RPM	514,3
Power(kW)	6.22
Nominal Liquid Head(m)	86
Generators	
Type	SSA 1.000
Quantity	2
Frequency (HZ)	60
Power (MVA)	6.8
Nominal Voltage (kW)	6.9

Table 2 – Specifications of the equipment used at PESHP

Small-scale baseline (without imports)	OM (tCO2e/MWh)	Total generation (MWh)
2001	0,9474	260.694.158
2002	0,9304	276.731.024
2003	0,9680	295.666.969
	Average OM (2001-2003, tCO2e/MWh)	Total = 833.092.151
		BM 2003 (tCO2e/MWh)
	0,9486	0,0937
	OM*0.5+BM*0.5 (tCO2e/MWh)	
	0,5211	

Table 3 - Brazilian South-Southeast-Midwest interconnected system baseline calculation

Annex 5. Bibliography

Arida, P., E. L. Bacha, and A. Lara-Resende (2004). *High Interest Rates in Brazil: Conjectures on the Jurisdictional Uncertainty*.

BNDES (2000). *O setor elétrico – Desempenho 1993/1999.* Bamco Nacional de Desenvolvimento Econômico e Social. Informe Infra-estrutura, nº 53.

Eletrobrás (1999). *Diretrizes para estudos e projetos de pequenas centrais hidrelétricas.* Centrais Elétricas Brasileiras S.A.

IBGE (2004). *Banco de dados Cidades@,.* Instituto Brasileiro de Geografia e Estatística (http://www.ibge.gov.br/).

Kartha, S., M. Lazarus and M. Bosi (2002). *Practical baseline recommendations for greenhouse gas mitigation projects in the electric power sector.* OECD and IEA information Paper.

OECD (2001). *OECD Economic Surveys: Brazil.* Organization for Economic Co-Operation and Development, Paris, France.

Schaeffer, R., J. Logan, A. S. Szklo, W. Chandler and J. C. de Souza (2000). *Electric Power Options in Brazil.* Pew Center on Global Climate Change.

UNEP-LAC (2002). *Final Report of the 7th Meeting of the Inter-Sessional Committee of the Forum of Ministers of Environment of Latin America and the Caribbean.* United Nations Environment Programme, Regional Office for Latin America and the Caribbean. 15 to 17 May, 2002, São Paulo (Brazil).