Energia Sustentável do Brasil

# Response to Global Stakeholder Consultation comments received as part of the CDM validation process of the Jirau Hydropower Plant CDM Project Activity

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## OBJECTIVE

After conclusion of the local stakeholder consultation according to the Brazilian regulation for the environmental licensing of hydropower plants as well as the conclusion of a CDM related local stakeholder consultation according to the provisions and criteria of the Brazilian DNA, the Jirau Hydropower Plant Project's PDD was published for global stakeholder consultation on the UNFCCC website. Global Stakeholder Consultation (GSC) initiated on 24 April 2012 and lasted for 30 days. As a result of the GSC three complementary submissions were received:

Jorge Molina Carpio, Senior Researcher and Director of the Institute of Hydraulics and Hydrology, La Paz, Bolivia, expressed concerns in relation to possible transnational social and environmental impacts of the Jirau Hydropower Project activity in Bolivia and Peru; Molina also claims those impacts were deliberately ignored in the Environmental Impact Assessment and the licensing process shows inconsistencies with Brazilian and international laws (Molina, 2012).

Philip M. Fearnside, of the National Institute for Research in Amazonia (INPA), Manaus, Brazil, criticized the CDM rules in relation to the criteria for the determination of project emissions related to methane and believes that it is not adequate to claim that the Jirau HPP reservoir would be a "minor" source of methane, since dams with small reservoirs and large installed capacities might reduce, but do not eliminate emissions from the reservoir surface. Fearnside also criticized the project to be not additional and claims that it will have impact on Bolivia's environment, economy and social life due to flooding and blockage of fish migration (Fearnside, 2012).

Brent Millikan, Amazon Program Director of International Rivers, claims that "the project has devastating and irreversible environmental and social impacts and it does not meet criteria for additionality" *(IR, 2012).*

Other comments by these authors question: the integrity of the Brazilian energy policy, regulation and environmental licensing process; the rules, criteria and procedures of the CDM; the legitimacy and environmental integrity of the Jirau CDM project activity as a GHG mitigation activity eligible for crediting and support according to the rules of the Kyoto Protocol.

Energia Sustentável do Brasil (ESBR) has analysed the submissions received and considers it a very good opportunity to clarify these doubts about the Jirau HPP project activity. In order to organize all aspects of the complementary comments received in a structured way and thus to make the responses transparent and accessible to a broader public this document summarizes the content of the three submissions. In addition, we are glad to provide complementary information that we deem of relevance to understand the project and its impacts and benefits in the context of the CDM and the Brazilian reality.

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# 1 Comments related to the environmental licensing process and stakeholders consultation

This section provides background information and responses to the comments that question the integrity of the Brazilian environmental licensing process. It provides a summary of the processes that led to the appraisal and definition of the Jirau HPP as part of the Madeira hydropower complex and how the possibility if impacts in Bolivia was assessed and the project was defined in a way which eliminates such impacts. In addition, the chapter provides an overview about the different stages of stakeholder consultation which were conducted first as a basis for the scoping of the Environmental Impact Assessment (EIA), second, for public consultation and approval of the EIA and last as part of the CDM validation process, which in fact was integrated into a constant and ongoing communication plan.

To allow a transparent and structured treatment, the comments were organized in thematic groups:

**a) Comments on integrity of the Brazilian environmental licensing process:**

**Summary of the comments from Fearnside and International Rivers (IR):**

According to the authors, the environmental licensing process is considered flawed and to suffer from political interference. One comment goes further: *"The planning, licensing and construction of Jirau HPP has been marred by repeated violations of Brazilian legislation and international agreements regarding human rights and environmental protection".* Several lawsuits filed by the Federal Public Prosecutor's office and reports by civil society organizations are cited.

**Background information to our responses:**

Before entering into a detailed response to the issues raised, it is important to reiterate that Brazil is a pluralistic society with division of powers and judicial independence and where free expression of opinion is a fundamental right. Furthermore the government is open to dialogue as exemplified by the fact that the Decanal Expansion Plan and the Energy Expansion Plan as developed by the Governments Energy Research Company (EPE) in 2006 and 2007 (MME, 2007a; MME, 2007b), as well as the National Plan for Climate Change Mitigation (PNSMC, 2008), all fundamental to the policy that led to the development of the Jirau hydropower plant, had been subject to public consultation. Furthermore, the regulatory bodies that are responsible for the regulation of the energy sector (ANEEL), of water use rights (ANA), environmental licensing (IBAMA), as well as the agency that represents the interests of the indigenous peoples (FUNAI) are independent governmental institutions that operate according to their missions and the country's legislation. Furthermore any citizen is free to be a plaintiff before an independent judiciary, as stated in the Brazilian Constitution[1]. Such a process is positive and healthy in

[1] Chapter 1, article 5, LXXIII - any citizen is a legitimate party to file a people's legal action with a view to nullifying an act injurious to the public property or to the property of an entity in which the State participates, to the administrative morality, to the environment and to the historic and cultural heritage, and the author shall, save in the case of proven bad faith, be exempt from judicial costs and from the burden of defeat.

maintaining the checks and balances and a certain understanding of the Brazilian regulation is required to derive a reasonable judgment of these processes. Furthermore, as in any jurisdiction based on the rule of law, only definitive judgments and rulings can be taken as solid evidence or reference for misconduct or regulatory failures.

The fact that the country is guided by democratic principles and that the current energy and climate change policies launched in 2007 are supported by the majority of Brazil's population is also illustrated by the fact that president Lula, when he ran for re-election in 2006, announced the intention to incentivise the development of hydroelectricity, biomass generation and other complementary resources (Ambiente Brasil, 2006). Likewise, during the presidential campaign, President Dilma stated very clearly that she would maintain Lula's policy of Climate Change Mitigation and promotion of hydropower and other renewable energy sources (Isto é, 2010).

Finally, it is widely recognized that Brazil today has solid and advanced regulation for the energy sector and environmental licensing and the objectives and progress of its Climate Change policy are widely recognized.

Based on, and in compliance with, these legal principles and the legislation for environmental licensing, the Jirau HPP was developed and licensed. The first and preliminary studies for preparation and the later approval of the Environmental Impact Assessment were conducted for the Madeira Hydropower Complex, which is composed by the individual plants Santo Antonio and Jirau. A detailed description of this Environmental Licensing Process and the stakeholder consultations that were conducted can be followed in its PDD. Without adding further detail to that description, we would like to stress that in the long and integrated process to obtain the Preliminary Licence (LP), the Installation License (LI) and the Operating Licence (LO) there is minute observation and compliance with the conclusions and conditions that were developed on the basis of multiple stakeholders consultations and with comments and requirements that were presented by NGOs and by public agencies such as National Indigenous Foundation (Funai); Iphan (National Institute for Cultural Heritage), Fundação Cultural Palmares (Afro-Brazilian heritage and cultural issues); Health Ministry; Federal Public Prosecution Office; state governments; municipal governments. As stated in the PDD, the content and results of the EIA were presented for broad public consultation in the form of a simplified Environmental Impact Report (RIMA) in 4 public meetings which engaged more than 3,000 people from downstream and upstream communities. These stakeholder consultations were officially announced and conducted by the responsible regulator and environmental authority IBAMA as a basis for finalizing and approving the EIA before issuing the Preliminary License. Nevertheless, and as explained in detail down further in this document, the preparation of the Environmental Impact Assessment itself was already based on numerous and detailed preparatory stakeholder consultations to assure that the scope of the EIA is adequate to capture the effective structure, demands and circumstances of the local society. These studies had been developed according to the Brazilian legislation by a consortium of Odebrecht and Furnas, with the support of Leme Engenharia, which were responsible for the development of the EIA/RIMA. A part of this preparatory consultation process, 32 communities were identified in the Project's (Jirau HPP and Santo Antonio HPP) influence

area and 64 stakeholder meetings were conducted in 2005 and 2006. As a result of this extensive consultation and discussion process, more than 200 proposals from these communities have been incorporated to the EIA/RIMA which was, subsequently, presented and discussed with the stakeholders during the 4 official public meetings held in November 2006 as a requisite for the issuance of the Preliminary License.

After each of those licences is conceded (LP, LI and LO), Jirau HPP is regularly supervised by local and national environmental agencies as well as by independent consultants hired by the financing banks which assess in detail the performance of the applicable socio-environmental programs and the compliance with national regulations. Each Licence can only be issued after all preliminary conditions have been met. The non-fulfilment of the requirements, conditions and processes implies in fines, prevents progress to the next licensing stage and may even result in the cancellation of the licence. Now based on the diligent implementation of all social and environmental programs that were required by the Installation license and defined in the Project's Basic Environmental Plan, ESBR has now requested the issuance of the Operational Licence from the Brazilian authorities and its issuance will confirm that all conditions of the Basic Environmental Plan have been fulfilled as required.

With regards to the cited civil public lawsuits and/or class actions in connection with environmental licensing and/or with the change of location of the dam and the consequences there from, ESBR wishes to inform that none of them has evolved or resulted in any preliminary or final verdict which would allow to identify that any undue or illegal action has been taken by ESBR. Appropriate evidence about this fact has been provided to the DOE (Edgard Leite, Advogados Associados, 2012).

Furthermore we want to reiterate that the Brazilian policy for setting priorities and rules for sustainable development, the definition of rules for expansion and regulation of the energy sector, environmental licensing and GHG mitigation is a matter of national sovereignty in observation to the country's obligation under its international agreements, such as for example the UNFCCC and the Kyoto protocol. In the basis of these facts, Brazil's Designated National Authority has established rigorous process for evaluation of any CDM project's contribution to Brazil's objective and priorities for sustainable development and strict observation of the environmental legislation as conditions for the issuance of the letter of host country approval.

A prominent Testimony about the importance of the Santo Antonio and Jirau Hydropower plants for Brazil's clean growth as well as the quality and rigueur of the environmental licensing process and the benefits that the projects offer was provided by Carlos Minc, at that time Brazil's environmental Minister, shortly after the issuance of Jirau's installation license, , as cited in Text Box 1:

**Textbox 1: Environmental Minister highlights the importance of a clean energy matrix to Brazil**

"The Brazilian Environmental Minister, Carlos Minc, highlighted today (17 November 2008) for the participants of the XII Brazilian Energy Congress about the importance to the country for having a clean, renewable and diversified energy matrix. According to Minc, this is one of the reasons why the environmental licenses for the construction of the new hydropower plants in Brazil need to follow meticulous requirements, not being done in a ruthless way. The minister mentioned the licenses cases for the construction of Santo Antonio and Jirau hydropower plants which, in each one of them, the responsible for the ventures are committed, as a matter of environmental compensation, to adopt the conservation units. "It is important that our licenses are quickly and rigorously done", said the Minister Minc (MMA, 2008, translation ours).

**Conclusion and responses to the comments from Fearnside and International Rivers:**

The licensing process of the Jirau hydropower plant was and is in full compliance with the Brazilian legislation and all conditions and requirements have and are being fulfilled to full satisfaction of the authorities. Any infliction or not observation of the legal requirements would lead to sanctions by the regulator and up to date all requirements have been met. No preliminary or final verdict exists which could indicate that ESBR has at any stage inflicted the Brazilian legislation. In addition to that, the Jirau HPP CDM project will be presented to the Brazilian Designated Authority, and demonstration of *"compliance of the project activity with the environmental and labour legislation in effect"*, (MCT, Resolution N°1, 2003) and demonstration of the project activity's contribution to sustainable development according to the priorities set forth by Resolution N° 7 and as described for local public's stakeholder consultation (ESBR, Annex III, 2012) which was conducted according to the rules of the DNA (MCT, Resolution N° 7, 2008) in the period from 28 March 2012 to 12 April 2012 are preconditions for host country approval.

**b) Consideration of possible impacts on Bolivia during the licensing process:**

**Summary of the comments from Fearnside, International Rivers (IR) and Molina:**

Fearnside, Molina and IR argue that the impacts of Jirau HPP are not limited to the main river course and that several socio-environmental impacts identified in the EIA (as listed in section D.2 of the PDD) would also affect the wider Madeira River basin in Bolivia and Peru. According to Molina *"Mandatory analysis and dialogue with neighboring countries regarding transboundary impacts on Bolivia and Peru"* has not been undertaken by the Brazilian government. According to the authors, one of the biggest impacts is the plant's effect on water levels along the bi-national stretch of the Madeira River, which would increase as a result of the sedimentation induced by the reservoir. Consequences would include loss of potential energy and an increase in the frequency and duration of floods on Bolivian territory. Contrary to what asserts the PDD, the feasibility study would effectively show that even if the reservoir is operated with varying levels, water levels in the Madeira River near the city of Abunã

would increase at least for medium and low flows. The authors suppose that ANEEL and EIA specialists denied their own results and relied on simple opinions of experts.

To back his arguments Molina indicates web links which are unrelated or functional, but together with IR he also refers to the preliminary IBAMA technical report No. 014/2007, issued a few months before the License was granted. The report refers to the possibility of rising water levels on the Bolivian side of the boarder as a consequence of sedimentation, impacts on fishing activities as a consequence of compromised migration of migrating fish species as well as the possible proliferation of malaria as a consequence of the project.

In addition to that, Molina also questions that the elimination of any flooding to avoid impacts on Bolivia would significantly reduce the energy generation potential of the Jirau HPP due to suboptimal use of the Madeira River Basin's hydro resources. This concern is also raised and discussed by Fearnside who identified that the operational rule which was defined to avoid impacts in Bolivia would lead to a loss of generation capacity and thus increase the project's financial additionality. Furthermore he observed that the final operational rule as established by ANA and which is cited in the PDD implies a further reduction to the operational levels which had originally been proposed by the EIA. Based on this, he understands that any possible future agreement between Bolivia and Brazil could increase the operational level and expand the electricity generation capacity of the plant, turning the Jirau HPP to "considerably less "additional" than the calculations presented to the CDM imply".

**Background information to our responses:**

To understand the evolutions that led to the installation license of the Jirau HPP in the current form it is important to know the preliminary studies for the development of the hydroelectric potential of the Madeira River. In fact the hydropower inventory of the Madeira River covered only the hydropower potential of the Brazilian stretch between Porto Velho and Abunã. It was developed by the consortium Furnas and Odebrecht and was concluded and approved in November 2002 (ANEEL, Dispatch N° 817, 2002). The inventory covers the Jirau and the Santo Antonio hydropower plants, together referred to as the Madeira hydropower complex, but does not contemplate the use of hydropower potential beyond Abunã. Based on this approved hydropower inventory, and in line with the Brazilian Environmental Legislation, IBAMA, the Brazilian environmental agency responsible for the licensing of the plants that integrate the Madeira hydropower complex, developed a Term of Reference (TR) (IBAMA, 2004) which is the compulsory fundament for the development of the Environmental Impact Assessment (referred to as EIA).

After IBAMA has conducted due inspections of the area and concluded public meetings in Porto Velho to discuss the draft, a final version of the document was issued in September 2004 as a basis for the elaboration of the EIA/RIMA of the Madeira hydroelectric plants. The works to develop the fundaments for this study started already in the year 2002 and in 2005, on the basis of the TR, the

consortium Furnas and Odebrecht submitted the EIA/RIMA to IBAMA to request the Preliminary License.

In addition to that it is important to recall that, in spite of the fact that the TR for the Madeira hydropower complex was limited to the Brazilian scope of the hydropower potential, the discussions were part of a broader scope for the development of an additional two hydropower projects in partnership with the Bolivian government. In fact such a complementation of the Madeira hydropower complex with a bi-national plant on the Mamoré and another plant of Bolivian nationality on the Beni River were considered as an opportunity to establish the waterway Madeira/Mamoré/Guaporé, which would connect Boliva to the Amazon and therefore to the Atlantic. In this context the proximity of Jirau HPP to Bolivia and Peru was treated as an opportunity for regional integration and with all applicable transparency during the whole environmental licensing process. In fact, during the preparatory phase of the EIA/RIMA several consultations and meetings with Peruvian and Bolivian governmental entities had been conducted, all of them duly referenced in the EIA. An extract of the respective meetings is presented in Table 1 (EIA, Volume A – 1).

**Table 1 – Main meetings with Bolivian and Peruvian agencies to present Rio Madeira Project**

| Meetings | DATE |
|---|---|
| With DPA Peru/Bolivia | 16.12.02 |
| With the Andean Development Corporation in Lima/Peru | 31.01.03 |
| With CAN – Lima/Peru | 31.01.03 |
| With Brazil's Naval Attaché & Bolivian Naval Officers in La Paz/Bolivia | 12.02.03 |
| With Bolivia's Economic Development Minister in La Paz/Bolivia | 13.02.03 |
| With the Andean Development Corporation in La Paz/Bolivia | 13.02.03 |
| With Bolivia's Housing and Basic Services Minister in La Paz/Bolivia | 14.02.03 |
| Meeting of the Brasil-Bolivia Joint Committee | 23.04.03 |
| Brazilian and Bolivian Presidents' meeting | 28.04.03 |
| With Bolivia's Minister of Works in La Paz/Bolivia | 10.12.03 |
| Americas's Forum Meeting in La Paz/Bolivia | 11.12.03 |
| Presentation to Bolivian Ministry of Defense in La Paz/Bolivia | 11.12.03 |

| | |
|---|---|
| **Launching of River Navigation Guide in Bolivia** | 11.12.03 |
| **With Bolivia's Energy Vice-Minister** | 22.01.04 |

On the basis of these circumstances, the TR developed and issued by IBAMA defined the Direct and Indirect Influence Areas (AID and AII) of Santo Antonio and Jirau HPPs complied with the TR issued in line with CONAMA's resolutions #01/1986 and #302/2002. Based on the definition that the underlying inventory was to be limited to the Brazilian territory, the AID and AII were defined accordingly. In addition, IBAMA established a third area of environmental characterization, named Regional Reach Area (ARR), with the purpose of identifying regional economic effects, also with regards to the possible prospects to integrate the Madeira projects into the Madeira/Mamoré/Guaporé, waterway.

Based on this TR, the EIA/RIMA was finalized and submitted to IBAMA in June 2006.

The EIA is also very clear about the scope of its study:

*"In spite of the fact that the focus of this study is related to the hydropower plants Santo Antônio and Jirau, [...], it is important to visualize their insertion in a wider context which may, in the future, imply two additional projects to form a complex of four hydropower plants to consolidate a waterway of 4.200 navigable km as part of a project for the logistic integration of Brazil, Bolivia and Peru. The analysis and description of the effects of such a complex, not only in the Amazonian context, were realized in the Strategic Environmental Assessment (Avaliação Ambiental Estratégica – AAE)"*

*"The Strategic Environmental Assessment has the objective to evaluate the implementation of a set of infrastructure projects in the region to understand their influence on the economic, social, environmental and institutional dynamics of this wide region."*

In fact, the Strategic Environmental Evaluation (AAE), which was developed in parallel to the Madeira River Complex, has a wider focus, beyond the state of Rondônia and also covering parts of Bolivia and Peru. As this region goes beyond the zone of direct and indirect environmental impacts, it was accomplished to offer a wider understanding of the hydropower plants economic influence and its possibilities to obtain benefits for sustainable development in the region. It covered the insertion of the Madeira Complex in regional and national economic strategies such as the electric, transportation and sustainable development plans, based on a parallel study of the interest groups, synergic and competing investments and the region's environmental conditionality. (Source: Complexo do Rio Madeira. Avaliação Ambiental Estratégica. Relatório Final. Arcadis/Tetraplan, Furnas, Odebrecht. 30/06/2005)

Now during the public consultation and evaluation of the EIA/RIMA by IBAMA, next to many other issues which lead to additional requirement for the development of complementary studies to address issues raised by IBAMAs professionals or issues raised during the public consultation process, there was also minute assessment of possible impacts on Bolivia, as well as the adequate mitigation measure

to eliminate this possibility. IBAMAs technical report No. 014/2007, even cited Molina as a testimony of these concerns as discussed at that time, which shows that they were taken serious and with the subsequent objective to define the conditions and requirements of the Installation License in a way which allows eliminating any impacts on Bolivia.

A fundamental premise for the development of the Jirau HPP was to avoid any possible cross boarder impact on the Bolivian territory. This implies first, that any increase in the water level or frequency and intensity of flooding at Abunã, which is located at the border to Bolivia, is to be avoided. Based on this fundamental condition, the Jirau HPP has been developed and licensed and its operation is regulated and will be monitored to avoid any non natural flooding in Bolivian territory. This fundamental requisite led to the definition of an operational rule to deal with variable flows, which is capable to assure that under all circumstances non natural flooding in the Bolivian territory as a consequence of the project's implementation is avoided. Reference to this principle can be found in the EIA (TOME E – VOLUME 1/3 – PHYSICAL ENVIRONMENT):

> *"Data available from the Hydropower Inventory Study allows defining Jirau HPP as a run-of-river plant with a maximum water level at. 90, 00 m, as necessary to keep the river system and its Bolivian tributaries unaltered, upstream Abunã (frontier Brazil - Bolivia).*
>
> *However, the topographic data gathered by the viability studies showed that if the regular water level of Jirau HPP reservoir is maintained at the Elevation of 90,00 m it can influence the Madeira river system upstream Abunã, affecting areas that were affected only during the flood periods.*
>
> *(...) Therefore, it was established that the Jirau HPP reservoir would be operated with variable water level according to levels defined in a Guide Curve, in order to keep the conditions of the river system upstream unaltered.*
>
> *The established Guide Curve (...) defines the monthly water levels that must be maintained at Jirau HPP so that the reservoir backwater does not interfere with the water levels of the Madeira River upstream.*
>
> *This way, Jirau HPP's operation at a variable water level accordingly to the Guide Curve can be characterized as an overall national project. It's important to stress that the established guide curve is valid only for planning purposes, considering the regular monthly flow. The reservoir will effectively operate according to effective monitoring of the back-water curves and a system of quantification and predicted inflows in Abunã based on a telemetric net of real time data obtained at the Madeira river basin."*

In order to refine and formalize this requirement and top establish the effective regulation to ensure and monitor the non-occurrence of any non natural flooding in the Bolivian territory as a consequence of the project's implementation, Resolutions 555/2006 and 269/2009 have been issued by the National Water Agency (ANA). The aim of Resolution ANA 555/2006 was to guarantee the necessary

hydro availability for Jirau HPP to operate, and Resolution ANA 269/2009 grants the Project the right to use hydro resources and defines the conditions of its operation in keeping Abunã's water level on its historically observed levels. When Jirau HPP starts to operate, these water levels, the outflow, inflow and downflow will be monitored daily. Solid discharges upstream and downstream will be monitored monthly. Besides, the topo-bathymetric sections will be monitored annually, in order to update estimates of silted up volume and the curve level-area-volume. Based on this monitoring, the guide curve will be assessed annually to guarantee the natural variation of water levels in Abunã is maintained. This means there will be no possibility of transnational water level elevation even as the result of a sediment formation caused by the reservoir.

Based on the progress in investigation and definition of adequate mitigation programs, especially when it comes to the topics of sedimentation, ichtyofauna and mercury, IBAMA issued on 9 July 2007 the conclusive technical opinion with the recommendation to issue the preliminary [redacted]stallation license on the basis of all applicable conditions and requirements which would have to be [redacted]dressed by any project developer in an adequate Basic Environmental Plan, suitable to mitigate the identified impacts, in order to obtain the Installation License.

In this respect it is important that the conclusive technical opinion, as issued by the environmental regulator as a basis for the Preliminary License for the Madeira hydropower developments, was issued only after all issues raised during the licensing process had been solved. This is referenced by the following extract:

> *"(...) it is possible to affirm that there was an improvement in the understanding and solution of the problems that had been identified and that there is no prohibitive barrier to the conclusion of the present status, the issuance of the preliminary license".*

References for the efforts to solve and address the issues that were raised:

> "In sight of a set of technical uncertainties, mainly related to the topics of sedimentation, ichtyofauna and mercury the Ministry of Environment promoted a sequence of technical meetings with specialists of prestigious knowledge, responsible technical staff from IBAMA, MMA, MME and the developing Consortium (Furnas and Odebrecht), with the intention to eliminate the pending doubts of the environmental licensing process.."

> "The Ministry of Mines and Energy, on 25 April, 2007 officially delivered at DILIC, technical Notes developed by specialists (...)"

> "It is concluded that, in spite of necessity for further clarification, new research and monitoring as well as the establishment of procedures, programs and projects, these activities can be undertaken in the process of the issuance of the effective Installation License (L.I.), a procedure that does not harm the objectives of the Environmental Licensing process. "

> "The attached Table "Impacts, measures and programs of the EIA" shows that the measures as indicated necessary in the preliminary technical opinion 14/2007 of COHID/DILIC were accepted and incorporated to large extend"

In conclusion, we can show that the avoidance of any environmental impact on the Bolivian side was a basic premise of the Environmental Licensing and that the Preliminary License was only granted once it was deemed feasible that these impacts could effectively be avoided if the appropriate measures are taken. This was later reaffirmed when the Installation License was issued on the basis of the detailed Basic Environmental Plan. Furthermore this will be monitored and audited to obtain the Operational License, as well as its regular renovations.

With regards to the question about the fact that the guidance to operate the Jirau HPP implies a reduced energy generation capacity we can confirm that the operation at a constant quota of 90 meters would allow generating higher volumes of energy, but, as defined by the EIA, this would imply that the water levels on the Bolivian side of Abunã would be elevated in the dry period and thus the project would not be contained to the national territory as defined by the original hydropower inventory as approved in the year 2002. Furthermore, such a measure would only be possible on the basis of a governmental arrangement between the federal governments of Brazil and Bolivia, as well as the subsequent environmental licensing on the Bolivian side, an issue which is beyond the scope of a the Jirau HPP concession which is clearly defined by the operational rule as issued by ANA.

In fact ANEEL (2008) in response to applicable requests for clarifications made clear that the firm energy of the Jirau HPP is only defined by the operational rule established by ANA (ANEEL, 2008), and therefore it is not realistic to suppose that it would have been an investment hypothesis to bet on such an arrangement for the Jirau HPP project's economic viability. As clearly defined by the regulator, such discussions are an exclusive responsibility of the federal government and obviously, any such agreement between Bolivia and Brazil would have to be based on a fair governmental agreement for sharing of any resulting benefits.

**Conclusion and responses to the comments from Fearnside and International Rivers:**

Since the definition of the Madeira hydropower inventory, the Madeira hydropower complex was defined to exploit only the Brazilian hydropower potential of the Madeira River and designed to limit any social and environmental impacts to the Brazilian territory. In any case, there were many bilateral discussions, not only about the project itself, but about the larger concept to establish the discussions about cross-border impacts which occurred in parallel to the licensing and were consequently used to define the operational rule and all environmental mitigation programs. Most important to this understanding is that the operational guide curve is not just a theoretic guideline, but that the operator has to effectively monitor the quota in Abunã and adjust the operation accordingly. This implies that no increased flooding in Abunã is possible. By the EIA and supplementary studies it was also shown that the high flows of the Madeira River eliminate the accumulation of sediments, especially beyond Abunã, where the river will flow in undisturbed manner. Now in the hypotheses that sediment would accumulate this would lead to a reduction of the operational level and thus increase flow rate in Abunã and thus eliminate excessive sediments as consequence of increased flow.

Finally, the hypothesis that the investor had speculated about monetary benefits related to a possible agreement between Bolivia and Brazil which would allow raising the operational quota to a constant 90 m throughout the year is against ANEELs (2008) guidance and therefore not applicable under Jirau's HPP hydropower concession which requires to comply with the operational rules define by ANA.

**c) Summary of process and results of the stakeholder consultation process:**

**Summary of the comments from Fearnside:**

Fearnside requires that the comments received during the stakeholder consultation of the official Environmental Licensing process should be addressed in the PDD

**Background information to our responses:**

As a matter of fact the PPs understand that the Brazilian DNA and the CDM only require to explicitly treat the local stakeholder comments that have been obtained as part of the CDM related local stakeholder consultation. Now as a matter of fact, the Jirau HPP did not receive any comments during this process, even though the issue was presented to and discussed with the Sustainability Committee, an action which was conducted in complement to the official requirements of the Brazilian DNA. Nevertheless, ESBR is happy to provide a summary of the different levels and procedures for stakeholder consultation which were implemented in preparation and during the development of the EIA. In fact, besides the official stakeholder consultation process undertaken in the context of the EIA/RIMA, as a legal requirement for the issuance of the Preliminary License, the consortium (Furnas – Odebrecht) responsible for the development of the EIA/RIMA has voluntarily organized a preparatory consultation process which involved 32 communities identified in the influence area of the Madeira Hydropower Complex (including Jirau HPP and Santo Antonio HPP). These preparatory meetings were held in 2005 and 2006 based on a pre-established methodology focused on transparency and broad participation of several actors. In order to conduct the pre-licensing consultation process, the consortium benefited from studies and researches carried on by prestigious and experienced institutions such as Federal University of Rondônia, Emílio Goeldi Museum, and the National Institute for Research in Amazonia (INPA) and the Tropical Pathologic Diseases Institute – IPEPATRO/RO.

The aim of pre-licensing consultation process was to help and improve the planning of the whole enterprise and the elaboration of the Environmental Impact Assessment (EIA) and Environmental Impact Report (RIMA) in respect to socio-environmental impacts over the identified communities and the understanding of their main concerns and social demands. This process also aimed to inform the stakeholders well in advance of the formal public consultation and discuss the projects with civil society groups and leaders, so that they could assess and propose mitigation and compensatory measures to be included in the EIA/RIMA prior to its official presentation in the formal public consultation.

The methodology applied in this pre-licensing consultation made use of social survey developed in the context of the EIA/RIMA for the identification of the following stakeholders:

A. Riparian population located in the Madeira Hydropower Complex area and downstream and upstream populations

B. Indigenous peoples

C. Urban population of Porto Velho

- Academic community, students
- Industry and commerce entrepreneurs
- Representatives of workers' agencies

D. Public Authorities

E. Media

Sixty-four meetings conducted by facilitators were held with the interest group "Riparian population located in the Madeira Hydropower Complex area and downstream and upstream populations". In this process, within an 18-month period, 61 communities of the area surrounding Jirau and Santo Antônio projects presented 320 proposals for impact compensation and mitigation.

The meetings provided the population dwellers of the direct and indirect influence areas of the projects information on their probable impacts. In order to assure their participation in the meetings, communities were advised two weeks in advance and were provided with transportation.

Overall, 32 communities close to the construction sites of the dams and 29 communities downstream took part in the meetings. The meetings were held in Jaci-Paraná and Santo Antônio, Abunã, Mutum-Paraná, Teotônio, Porto Velho, São Carlos and Calama.

Throughout the 18-month long process more than 64 meetings were held. In all occasions it was made clear that the meetings intended to inform about the expected impacts of the hydropower projects and to hear dwellers' opinion on what could be done to reduce or compensate such impacts.

Also during the preliminary licensing process, in addition to the aforementioned 64 meetings with river bank populations, there were meetings with other groups of interest such as:

Indigenous Peoples: six meetings in villages, which have reached an estimated public of up to 1,500 Indians.

Urban population of Porto Velho: Creation of *Projeto GeraAção Rondônia* to expand communication with the academic community and youngsters of Porto Velho. In order to achieve this goal, an opinion

research was carried out and open meetings were held with higher education institutions, youth movements and the general public. Those activities involved 16 presentations to rectories and boards (91 attendees) and in academic meetings (898 attendees).

As a result of the first phase a Discussion Cycle was organized with higher education institutions, entrepreneurial organizations and the civil society of Porto Velho. Three days of debates attracted at least 734 people, among them representatives of the Public Prosecution Office and of organizations that represented working and professional classes and civil society groups.

At the end of the Discussion Cycle a tabloid was published with 4,000 copies fully describing the whole Cycle, and it was distributed as a supplement in the dailies *Diário da Amazônia* and *Diário de Rondônia*. Other 24,000 copies were inserted in the newspaper *Alto Madeira*, thus disseminating the debates with civil society even more.

After this preparatory phase, in compliance with regulations and within the licensing scope of the Madeira River Hydroelectric Power Plants – Santo Antônio and Jirau, several official hearings and public meetings were called and presided by IBAMA. More than 3,000 people attended these calls:

5.14.2004 – Official public meeting in Porto Velho: debate on the draft Reference Term, 95 attendees.

11.10.2006 – Official public hearing in the Jaci-Paraná district attended by almost 800 citizens.

11.11.2006 – Official public hearing in Porto Velho with the presence of about 1,100 citizens.

11.27.2006 – Official public hearing held by the State of Rondônia Public Prosecution Service: presentation of the "Contents Analysis Report of Environmental Impact Studies (EIA) and Environmental Impact Report (RIMA) of Santo Antônio and Jirau Hydroelectric Developments on the Madeira River" with IBAMA representatives.

11.29.2006 – Official public hearing in the Abunã District with the presence of 404 citizens.

11.30.2006 – Official public hearing in the Mutum Paraná District attended by 669 citizens.

01.25.2007 – Official public hearing at the Calama community, located downstream the area proposed for the damming of Santo Antônio Hydroelectric Development.

Clear and straightforward discussions with local civil society and public authorities resulted in mutual trust and tacit agreements so that all could benefit from the implementation of the Madeira River Power Complex.

**Conclusion and responses to the comments from Fearnside**

The importance given to discussions by these communities was reflected in the fact that they contributed to the organization of meetings, provided space and equipment, mobilized friends and gave up leisure activities to participate.

The main aspects discussed during consultation were: relocation; job opportunities; business opportunities; fishing monitoring; social compensation (works); neighboring communities interference; recovery of affected infrastructure; filling of reservoir; labor Issues; public health program; deforestation; support and sponsorship; technical information on construction works; archaeology; social compensation (capacitation); fauna monitoring and rescue; hydro biogeochemical monitoring; downstream actions program; mining activities follow-up program; water table monitoring program.

The communication and social interaction strategy based on dialogue, respect and trust and the contributions derived from the official public hearings were registered and taken into full consideration in the licensing process.

The demands surveyed were included in the Basic Environmental Project (PBA in Portuguese) approved by IBAMA. JIRAU HPP's PBA has designed 33 projects, already implemented, which are described in our PDD.

## 2 Comments and questions about specific environmental impacts

This section summarizes comments and questions received in relation to specific environmental impacts which could potentially be related to the Jirau HPP. Specifically the relation of the project activity's development with forest conservation and the mitigation of impacts on fish migration patterns and subsequent impact on fishing activities are being addressed.

**a) Comments about Jirau HPP and its relation to deforestation**

**Summary of the comments from Fearnside and International Rivers (IR):**

In its submission, International Rivers (IR, 2012) accuses the Madeira hydropower plants to have caused increased deforestation in the years 2010 and 2011 and Fearnside (2012) says that *"current deforestation rates have skyrocketed in the immediate vicinity of Jirau and the adjacent Santo Antônio dam: this area was the number one hotspot of deforestation in Amazonia in December 2010"*. IR refers to INPE for the data, but does not identify the data set used. IR declares that this increased deforestation is caused by direct intervention in the forests, as well as by augmentation of informal deforestation activities resulting from work force migration to the region.

In addition, Fearnside sees the risk that the possible establishment of a waterway might impulse soybean agriculture in the region and thus lead to increased deforestation. Furthermore he understands that such land use emissions should be considered project leakage.

IR also details that in 2009 140,000 hectares of Reserva Estadual do Rio Vermelho protected area were *reduced* to accommodate Jirau HPP, and that in order to offset the reduction, 140,000 hectares were added to the existing Reserva Federal do Rio Pardo. Yet only 70,000 hectares of the offset area

consisted of forested land while the remaining 70,000 hectares consisted of land for agricultural production occupied by 5,000 families. IR ends by concluding that the resulting effect was a net loss of 70,000 hectares of forested areas attributable to Jirau HPP.

**Background information to our responses:**

To understand and asses the criticisms raised by Fearnside and IR it is important to consider that the key motors of deforestation in the Amazon region are poverty, lack of employment opportunities and the non-enforcement of environmental laws, all of which lead to illegal logging and deforestation mainly for cattle raising activities. The state of Rondônia has traditionally been a hotspot for these activities and for decades has presented one of the highest deforestation rates in the country. According to the results of the Program of Deforestation Assessment in Brazilian Legal Amazonia (PRODES, 2011) of the National Institute of Space Research (INPE) historically monitored data signals that deforestation in Rondônia state was definitely higher between the 1980s and the beginning of 2000. The Figure 1 below shows annual deforestation rates between 1988 and 2011.

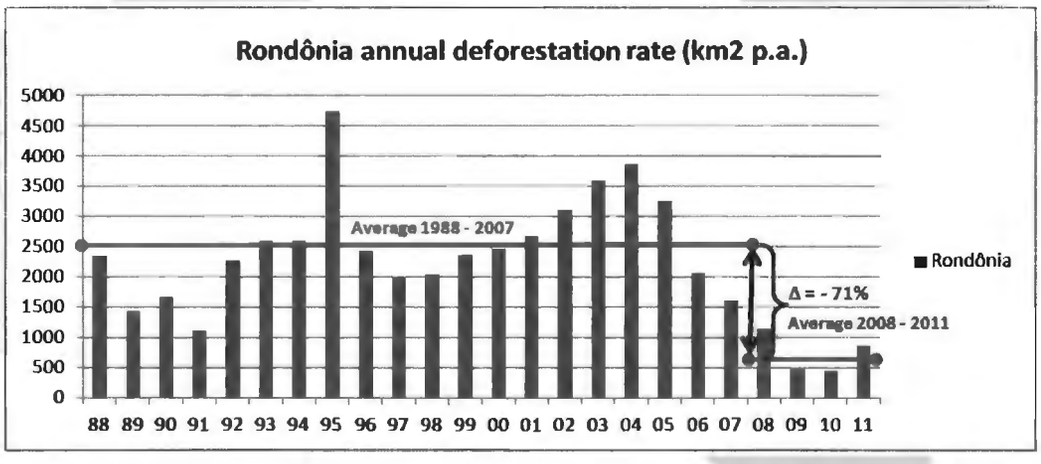



**Figure 1: Evolution of deforested area in Rondônia State 1988-2011**

As it can be seen, in 1995 deforestation in Rondônia State achieved its highest and most impressive deforestation point - of approximately 4,700 $km^2$ – at a time lacking effective governmental monitoring, supervision and control of deforestation and illegal mining and extracting activities. However, deforestation in Rondônia decreased significantly after 2007 and reached an average deforestation rate below 730 $km^2$ between 2008 and 2011, a reduction of more than 71% compared to the average deforestation rate in the period 1988-2007. It is no coincidence that the annual deforestation rate started to decrease after 2007 not only in Rondônia, but in all Amazonian Region. In that year, the Brazilian government adopted several regulatory measures to integrate climate change mitigation activities to its policies. The Brazilian Environmental Ministry (MMA, 2007) spearheaded several measures in order to fight deforestation and climate change. In this regard, when comparing data from 1988-2007 to data from 2008-2011 (the implementation period of Jirau HPP) we see a reduction in the annual deforestation rate of about 71%, making it impossible to associate the project's implementation to an increase in the deforestation rate in the region. On the contrary, it is possible to point a relation between the project's implementation and the reduction of the annual

deforestation rate, based on the intensification of the Brazilian government's efforts on climate change issues. In 2007 a Presidential Decree created a Secretariat on Climate Change and Environmental Quality within the Environmental Ministry (Decree Nº 6.101, 2007). In compliance with the ratification of the Kyoto Protocol, amongst the Secretariat's attributions is the development of an environmentally adequate energy matrix; to propose policies and economic tools for regulating the carbon market (CDM) regulation; to support the broader use of environmentally adequate energy alternatives; to develop policies and strategies for the mitigation and adaptation to global climate change and its consequences.

Therefore, Jirau HPP is part of a broader context which aims to reduce deforestation and promote clean and sustainable development growth in the country. In fact, it is expected that Jirau HPP CDM project will contribute to the sustainable development in the country as it will replicate what has been observed in other hydropower plants in the country: Human Development Index (HDI) is higher in the surrounding areas of hydropower plants in many regions and environmental protection is more effective, which is confirmed by social-environmental programs and investments promoted by the Brazilian Government (MME, 2007a, p 15).

In relation to the question about direct forest interference it is important to explain that some suppression of vegetation in the area of the future reservoir were defined by the Environmental Impact Assessment and the Basic Environmental Plan to minimize adverse impacts of degrading biomass on the water quality of the reservoir, also to ensure suitability for multiple usage.

The activities are being implemented following the requirements and conditions of the Authorization for Suppression of Vegetation (ASV) nº 447/2010 and nº 530/2011 as issued by IBAMA (2010/2011), following the stages and process defined by the Reservoir vegetation suppression program.

The company Intertechne Consultores S.A. (INTT) was contacted by ESBR to plan, manage and control these activities to guarantee that they are implemented in line with best practices to protect environment, health and safety.

On the allegation that a waterway will impulse soybean agriculture in the region and lead to increased deforestation and they should be considered project leakage, Jirau HPP would like to clarify that in case waterways are constructed in the future, they would represent a totally new project to be evaluated, approved, licensed and implemented according to regulations of the Transport Ministry and the National Agency for Aquatic Transportation (ANTAq). Jirau HPP has no influence or responsibility on the hypothetical possibility of waterway being constructed on the Madeira river and cannot be held responsible or have project leakage attributed to events outside the scope of the project. Therefore, definitely such claim does not apply to Jirau HPP CDM project.

Regarding the allegation that Jirau HPP has caused a net loss of 70,000 hectares of forested areas, project developer has some good news to present.

The Brazilian Environmental Ministry (MMA), the Institute Chico Mendes for Conservation of Biodiversity and the government of Rondônia devised a way to preserve the National Forest Bom Futuro (Flona). An area of 70,000 hectares (about 25% of Flona) occupied by 5,000 families will be converted into an Environmental Protection Area (APA), with a sustainable management plan and exploration projects (MMA, 2009). Another preserved area of the same size in Flona will be converted in state forest (FES), an official environmental reserve. Other 130,000 hectares of the Flona Bom Futuro will be decreed Conservation Units (UC) with strict preservation measures.

The agreement also establishes that the government of Rondônia donates well preserved 172,430 hectares to Mapinguari National Park. This area is located along the left bank of Madeira River and borders Jirau HPP's area of influence. The government of Rondônia, in line with the Terms of the Agreement, amended the Complementary Law 581 of 30 June 2010 that creates the APA and the FES Rio Pardo in a preserved area of National Forest Bom Futuro, This complementary law led to the creation of the Sustainable Forest Rio Madeira A, Rio Vermelho A, Rio Vermelho B and the Ecological Station of Mujica Nava and Serra dos Três Irmãos. In this way an increase of the protected area assures the environmental preservation of the region, as can be seen in the table below.

| **Enlargement of the Conservation Unit (UC)** | | **State Conservation Units converted** | |
|---|---|---|---|
| **UC** | **Area (ha)** | **UC** | **Area (ha)** |
| PARNA Mapinguari | 172,430 | Rio Vermelho Sustainable Forest A | 38,688 |
| | | Rio Vermelho Sustainable Forest B | 31,569 |
| | | Mujica Nava Ecological Station | 18,280 |
| | | Serra dos Três Irmãos Ecological Station | 9,966 |
| **TOTAL** | **172,430** | **TOTAL** | **98,503** |
| **Net Increase of protected area** | | | **73,927** |

**Table 1: Balance of Conservation units created in the region of the Jirau HPP**

**Conclusion and responses to the comments from Fearnside and International Rivers:**

In conclusion, it is evident that the implementation of the Jirau HPP contributed to the implementation of a new arrangement which resulted in the expansion of the federal Mapiguari National Park by a total of 172,430 ha based on the integration of 98,503 of previously well preserved state owned Conservation Units, as well as by adding 73.927 ha of previously unprotected areas. Therefore, there

has not been a reduction of the Rio Vermelho conservation units, but and integration and complementation with new areas to create a bigger Conservation Unit. In addition, this expanded federal conservation unit now effectively uses the Jirau HPP reservoir as limit and spans over the border to the Amazonia. This geographic expansion and integration on the basis of more stringent federal legislation is a significant step to contribute to the permanent reduction of deforestation in the region.

On the other hand, the example of the Flona Bom Futuro, which is not related to the integration of the Rio Vermelho areas into the Mapinguari Park, was not contemplated in the table above. Nevertheless the example shows how it is possible to legalize an unsustainable situation of illegal population in a context of forest conservation and sustainable management and thus not only prevent further illegal degradation of the area, but also to integrate the local community by providing them legal certainty and support.

In summary we have shown that the implementation of the Jirau HPP is in line with and supportive to the governmental policy of forest protection and climate change mitigation.

**b) Comments about possible impact son fish migration and fishing activities**

**Summary of the comments from Fearnside and International Rivers (IR):**

As part of their submission, Fearnside, International River and Molina accuse the Jirau HPP Project of causing great impact on fishing activity in the Madeira river basin due to the interruption of upriver migration, mostly of the catfish species.

They also criticize the efficiency of the fish passage system (referred to as STP in Portuguese) which is foreseen for Jirau HPP and defined in the EIA's complementary studies of 2006 to mitigate the impacts: "Fish passage systems do not guarantee the passage upstream of adult fish and have no effect on the passage downstream of eggs and larvae. The existence of two consecutive reservoirs (Santo Antônio and Jirau) increases the uncertainties. Fish passage systems can act as introducers of *alocton* species in the subsystems upstream and downstream of the *cachuelas* (rapids and low waterfalls) [...] the impact on fish migration extrapolates the limits of Brazilian territory and interferes in transnational stocks and fisheries production in Brazil, Bolivia and Peru". In addition to that, the PDD and EIA are also criticized for not providing technical evidence that bulb turbines do not damage fish eggs and larvae which flow down the river.

Molina also says that the construction of two projects with their respective reservoirs aggravates the situation. As a result of this impact, indigenous and Bolivian riparian communities would be highly affected since they depend on fishing activity.

**Background information to our responses:**

The construction of a Fish Passage System, along the dams of Santo Antônio and Jirau HPPs was proposed in the Environmental Impact Assessment (EIA) to mitigate the possible impact of these projects on the long-distance migration of fish along the Madeira River, especially of big catfish whose known spawning areas in the sub-basin are located upstream Jirau HPP.

Jirau HPP's STP has been designed and is being evaluated by renowned specialists on ichthyofauna who confirmed the environmental feasibility of the project. STP are designed and operate according to the peculiarities of local ichthyofauna, and constant monitoring of the species' response to hydraulic stimuli of attraction and selectivity and the mechanic transportation up to the reservoir grants the efficiency of the system.

*Brachyplatystoma flavicans* (catfish) was defined as most important target species and the assessment of STP's efficiency is based on this species. Hydraulic conditions and geometric shapes of the system were determined to favor this particular species and to prevent the passage of species that are foreign to the upstream stretch of the project. In addition to that, the passage of some migratory species other than to *Brachyplatystoma flavicans* is promoted by the Conservation Program of Ichthyofauna (PCI) to assure gene flow of population strata above the dam, even if the species have self-sustaining populations upstream and downstream at the Jirau HPP.

Evaluation of the efficiency of the STP is being implemented by the Monitoring Subprogram of the Fish Passage System foreseen in the Conservation Program of Ichthyofauna of Jirau HPP (item 4. 17 of the Basic Environmental Project – PBA).

Additionally, it is noteworthy that features which favor ichtyofauna conservation were already defined and incorporated to the basic and detailed design of the project; these include a change in the geometry of the dam axis to prevent the formation of backwater areas that could work like traps to eggs, larvae and juvenile fish that swim down the river along the current. Results obtained by the Subprogram of Ichthyoplankton indicate a lack of vertical or horizontal stratification in the distribution of eggs, larvae and juvenile fish along the stretch of rapids in the Madeira River, which points their dispersal.

Thus, experimental designs to evaluate mortality-survival of eggs, larvae and juvenile fish of ichthyofauna during their passage through different stretches of the Madeira River were foreseen in the Conservation Program of ichthyofauna of Jirau HPP (item 4.17 of the Basic Environmental Project – PBA), operating since 2009, including passage through the spillway and turbine. The comparison of data obtained before and after the filling of the reservoir will lead to a better understanding and handling of this component of the biota.

Another favorable design feature is the use of bulb turbines as questioned by Molina. In fact, comparative analyses of bulb and Kaplan turbines show the favorable features of bulb turbines (Pavlov DS, Lupandin AI, Kostin VV. 2002; Godinho and Boyd Kynard 2008; Andritz, 2008; Odeh M., 1999). As

presented in the Feasibility Study, these turbines minimize the impacts on the aquatic fauna because they have fewer blades, low turning speed and have larger runner diameters.

Several studies on pressure variation, blades friction etc., suggest that mortality associated to the passage through turbines can be relatively low in low head plants with Kaplan or Bulb turbines. In addition, ESBR has investigated for additional solutions to reduce even further the impacts on the aquatic fauna. Among others: turbines are water-cooled to prevent water pollution; large, but slow turning turbines (the biggest bulb turbines in the world) with relatively small blade dimension decreases further the risk of mortality; creative technical solutions for zero fish mortality during units' outages; Jirau's specific design, developed for fish transport systems, enhances the selective passage of fish and allows migratory fish passage, but restricts the passage of those fishes who would not have naturally swam up the river. One system is in rock and the other in metal, to guarantee the spawning and genetic flux of all concerned species.

Moreover, since 2009 the Fishing Activity Support and Monitoring Program (item 4.30 of the PBA) follows-up of commercial, craftwork and subsistence activities among riparian communities in the project's area of influence. This Program is to be active before, during and after the project's implementation and aims at contributing to the sustainability of fishing activities in the Madeira river basin and monitoring possible impacts of the project's implementation and reservoir's formation.

**Conclusion and responses to the comments from Fearnside and International Rivers:**

Based on the EIA and supplementary studies from prestigious specialists, an effective Fish Passage System is being implemented to guarantee the upriver migration of *Brachyplatystoma flavicans* (catfish) and to promote gene flow of other migrating species, while exotic species are being prevented from migration. In addition, we have provided references which show that bulb turbines allow down river migration of ichthyoplankton. This is also favored by the construction and reservoir configuration and both migration and downstream of ichthyoplankton is being monitored to guarantee efficiency.

## 3 Comments on Environmental Impacts with Potential Health Hazards

This sections responds to the expressed concerns about a possible increase in the rates of malaria transmission in consequence of the project's activities and explains what Jirau HPP project has agreed with health authorities in order to curb malaria transmission and explains what is being done regarding residual mercury contamination due to previous mining activities and the plans to monitor mercury deposits when found.

### a) Comments and questions about possible Malaria proliferation

**Summary of the comments from International Rivers (IR):**

As part of its submission on the socio-environmental quality of the Jirau HPP project, International River claims project activity will increase malaria risk. Likewise, Molina adds that the proliferation of malaria would impact Bolivia and Peru.

**Background information to our responses:**

ESBR recognizes that, if not correctly managed, there would be risk of increased incidence of malaria as a consequence of project activity, which was correctly identified on the EIA. This led to the design and implementation of adequate and effective measures.

Malaria transmission occurs through female mosquitoes of *Anopheles* gender. In South America the species *Anopheles darlingi* is the main vector and it reaches humans mainly in the household and its surroundings. The natural breeding sites of *A. darlingi* are basically found in soil and large water collections with water speed almost zero, natural shade and the presence of macrophytes.

Malaria transmission involves biological, ecological, geographic, economic, social and cultural factors combined together or linked in pairs. Determining factors account for the emergence and spread of the disease, and conditioning factors favor the maintenance of the disease for long periods.

Malaria transmission determining factors are: i) susceptible population; ii) etiologic agent; and iii) presence of the vector. Conditioning factors for high incidence are related to the etiologic agent and point to the resistance to antimalarial drugs; delay in diagnosis and treatment; and weakness of epidemiological surveillance.

Brazilian environmental licensing process has advanced considerably with respect to environmental obligations of projects in Amazonia regarding malaria, and if a projects' activities increase the risk factors of malaria cases in endemic regions, it must conduct epidemiological studies and programs to control the disease and its vectors. Accordingly, the Ministry of Health established standards and procedures for the implementation of projects subject to environmental licensing processes (CONAMA Resolutions 01/1986 and 237/1997).

By means of this legal provision ESBR, together with technicians from the Municipal Health Department of Porto Velho (SEMUSA), the State Health Department (SESAU) and the Ministry of Health (MS), has developed the Action Plan for Malaria Control (PACM) for the areas of direct and indirect influence of the project, organized based on the map shown in the figure below. The municipality of Porto Velho is divided in 9 (nine) epidemiological regions. The areas of influence of Jirau AHE are the 3$^{rd}$, 4$^{th}$, 6$^{th}$ and 7$^{th}$ regions.

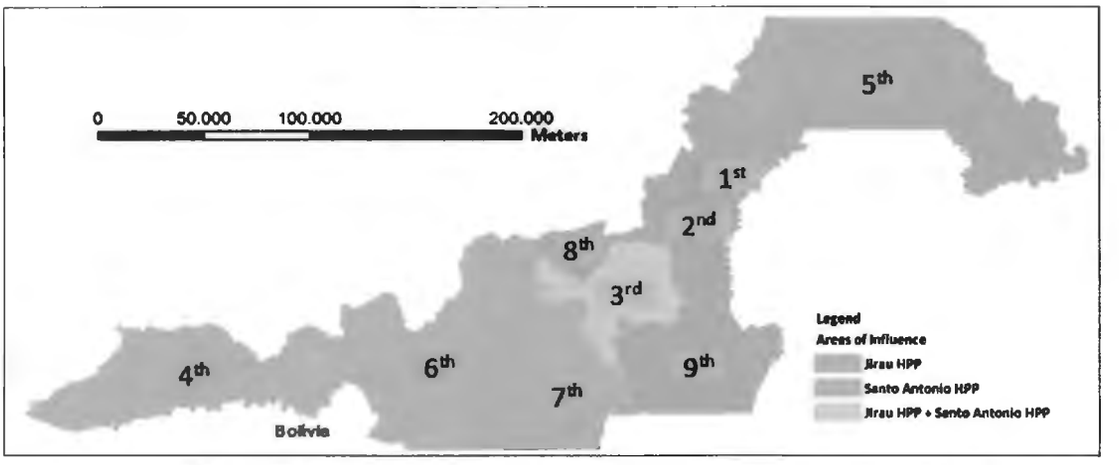



**Figure 2: Map of the municipality of Porto Velho, Rondônia, its epidemiological divisions and the areas of influence of both HPP projects on the Madeira River.**

Investments on disease control were in the range of R$ 5,581,800. It is noteworthy that in the construction site there is a specific plan of prevention measures and disease control in the work fronts and housing sites, all in compliance with Brazilian legal provisions regarding occupational safety and health.

Resources are acquired or contracted by ESBR and provided to the Municipal Health Department of Porto Velho (SEMUSA), responsible for implementing the disease control. Actions focus mainly on timely diagnosis and treatment; active search of malaria cases; investigation and epidemiological monitoring; health education and social mobilization; entomological investigation; selective control of vectors; indoor residual spraying, spatial fogging and installation and use of long-term mosquito nets impregnated with insecticide.

In addition to direct investments to control malaria, epidemiological surveillance service of the municipality has received investments for structuring the network, strengthening the industry and expanding the scope of actions, providing higher performance in all epidemiological regions. Investments in this sector correspond to R$ 7 million.

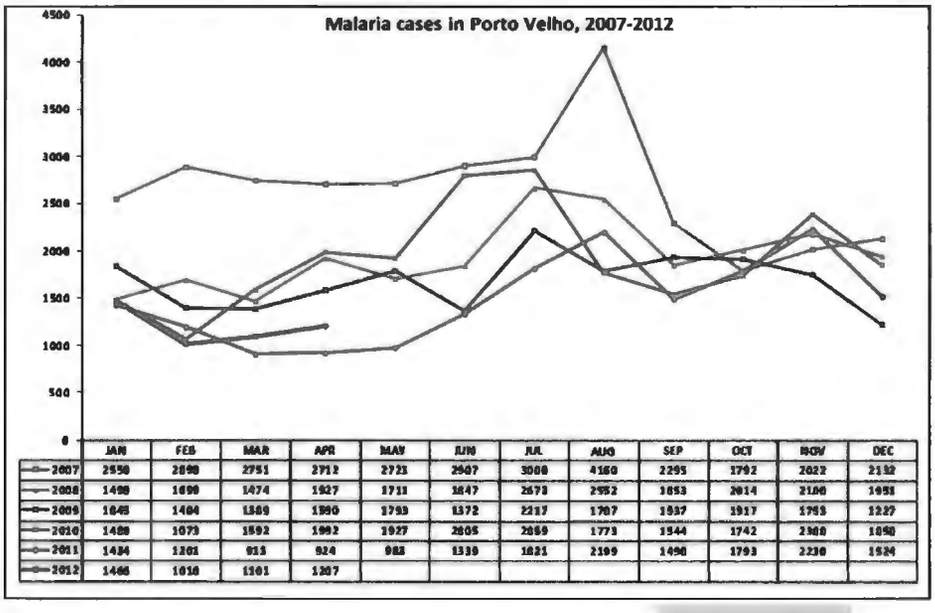
**Conclusion and summary of results achieved**

The number of malaria cases has been declining since the implementation of hydropower projects on the Madeira River in 2008. For decades, the municipality of Porto Velho was considered a high risk of transmission zone. In 2011 the reduction in the number of cases was of 25%, and for the first time in its history the region became a zone with average risk of transmission.

In the area of influence of Jirau HPP, the number of cases is smaller than prior to the implementation of the project in 2007. By the Bolivian border, in regions 4$^{th}$ and 6$^{th}$, reduction was quite significant, 24.3% and 25.0% respectively in 2010 and 2011 (Annex 1, Figure 5 - **Erro! Fonte de referência não**

**encontrada.**). Municipal, inter-municipal and international population movement along the frontiers of Rondônia and Bolivia has been monitored by technicians for vector control. Monitoring in Nova Mamoré and Guajará-Mirim (outside the project's area of influence) in the Bolivian border also indicates a reduction in the number of cases. Between 2010 and 2011 the reduction in cases in Nova Mamoré was of 15.3% and in Guajará-Mirim of 45.5% (Annex 1, Figure 9 - Figure 10).

In addition to this, it is important to repeat that the natural conditions of the river will be preserved in Abunã, at the frontier between Brazil and Bolivia as required by ANA, Resolution 555, 2006 and ANA, Resolution 269, 2009. Thus, due to absence of any flooding or interference with the tributary rivers on Bolivian or Peruvian territory related to the Jirau HPP implementation, the concern that the project activity would lead to increased vector incidence in those regions does not have fundaments. Consequently, the vector population will remain constant and is not influenced by the project activity.




| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2007 | 2550 | 2898 | 2751 | 2712 | 2721 | 2907 | 3000 | 4180 | 2295 | 1792 | 2022 | 2192 |
| 2008 | 1498 | 1690 | 1474 | 1927 | 1711 | 1847 | 2673 | 2552 | 1853 | 2014 | 2180 | 1951 |
| 2009 | 1845 | 1484 | 1589 | 1990 | 1793 | 1372 | 2217 | 1707 | 1937 | 1917 | 1795 | 1227 |
| 2010 | 1488 | 1073 | 1592 | 1982 | 1927 | 2605 | 2859 | 1773 | 1544 | 1742 | 2388 | 1850 |
| 2011 | 1434 | 1201 | 913 | 924 | 983 | 1338 | 1821 | 2199 | 1498 | 1793 | 2230 | 1524 |
| 2012 | 1466 | 1618 | 1301 | 1287 | | | | | | | | |

**Figure 3: Malaria cases in Porto Velho, 2007-2012 (Source: SIVEP-MALÁRIA/MS/SVS, updated May 17, 2012).**

**b) Comments and questions about mercury**

**Summary of the comments from Fearnside:**

As part of his submission Fearnside makes reference to Mercury methylation as being a project impact not cited in the PDD.

**Background information to our responses:**

In fact ESBR had only cited in the PDD the impacts that are classified as significant by the EIA, which is in line with the CDM rules, but we are happy to provide information about this issue and have included reference in the PDD. To understand the topic it is important to recognize that the sources of mercury, next to natural geological sources, are mostly related to unsustainable economic activities which are not related to the Jirau HPP project activity, such as Mining and Deforestation.

In fact, the upper Madeira river basin was the second most important gold mining area in the Amazon between the 70's and 90's, with a peak in the 80's. Mining activities are mostly executed in artisanal and non regularized manner and use mercury for gold extraction. Though the level of activity has reduced it is still a common practice in the Madeira basin.

Another source of Mercury is the intense land use and deforestation in the region which mobilizes mercury that is then deposited in the river sediment (Lacerda, 1998; Roulet et al, 1998).

In addition to that, natural Mercury sources stem from erosion in the Andees and are brought into the Madeira River bed as part of the sedimentation.

As a consequence of this situation, mercury exposure due to natural or anthropogenic sources is a general issue in the Amazon region and not an attribute of the Jirau HPP. Thus the question is if the implementation of the project has an impact on this situation and on the exposure of the local population.

In this context the Hydro-bio-geochemical Monitoring program has been defined to allow environmental and human bio monitoring in the pre and post impoundment phase. The monitoring program determines concentration of organo-metalics, evaluates the risk of human exposure, as well as potential negative impacts on health of the communities that live along the Madeira river course. The program also includes an information campaign to educate the local population about the general risks and adequate behaviour (ESBR Relatório Final IBAMA, 2012).

So far 10 measurement campaigns have been conducted to determine different forms of mercury in soil, water, sediment and biosphere. Results for water are below the reference values for natural sweet water courses defined by Resolution CONAMA no 357/2005, as well as those for drinking water as defined by the Health Ministry (Portaria no 2.914/2011). In addition, levels or organic mercury are below 10% of the total mercury content, which shows that there is no specific concern in the Madeira river course. Likewise, mercury concentrations found in soil are below the precautionary value as defined by Resolution CONAMA nº 420/2009. Likewise the values found in sediment, phytoplankton, invertebrates and fish, as well as the values measured in the local population are fully in line with the normal levels in the Amazon region (Venturo, 2012).

In summary, the program so far has allowed to establish a sound understanding of the mercury exposure of the region and up to now no specific concerns were identified. In addition, as the Jirau HPP does not materially interfere with the natural behaviour of the watercourse and will only flood areas that are already regularly exposed to natural floods it is not expected that the implementation will change as a consequence of the project and the ongoing studies and water quality and stratification behaviour do not only show that no stratification and anoxic zones exist, but also that their formation after impoundment are not expected due to low depth and high flows (LIFE, 2011). In any case, the monitoring program will allow identifying any significant change in relation to the water

quality and mercury content when compared to the baseline which is being consolidated on the basis of the ongoing measurements (Venturo, 2012; ESBR Relatório Final IBAMA, 2012, LIFE, 2011)

In addition, since the start of construction activities of Jirau HPP, the Technical Follow-Up Program of Excavation in Areas of Potential Mercury Accumulation (Annex 08 of the Environmental Program for Construction (PAC)) is being performed in compliance with requirement 2.9 of the Preliminary License (LP) nº 251/2007 for Santo Antônio and Jirau HPP.

This program requires excavations in areas of probable mercury accumulation and its proper removal and disposal in case it is found; monthly visits to the construction site to identify possible diffuse sources of mercury and to monitor the total mercury contents (HgT) in the excavated material, which, if contaminated, is to be removed, treated and assessed before its final disposal.

Between March 2009 and February 2012, 224 samples of soil were collected in the Construction Site area for analyses of total mercury contents. Mercury concentration therein presented a decreasing tendency with the development of excavation since this material comes from deeper horizons without the contribution of atmospheric deposition of the metal. Total mercury values from 2 to 10 times lower to the values defended by CONAMA Resolution 420, 2009 were found, with no evidence of mercury contamination whatsoever. The results of this Program are submitted to IBAMA twice a year, in compliance with what is determined in requirement 2.1 of Installation License (LI) No. 621/2009 (IBAMA, 2009_06_03).

**Conclusion and summary of results achieved**

Mercury is to a great extend related to past unsustainable and uncontrolled mining practices and the implementation of the Jirau HPP is being conducted with all due care to identify and remediate such historic environmental liabilities. Up to now 10 measurement campaigns have been conducted to identify any critical concentrations of mercury, but so far all measurements in water and soil have obtained results which are far below the reference and threshold values as established by the Brazilian regulators and the measurements in sediment and biosphere indicate that values are in line with the general background level in the Amazon region. This, in addition with the fact that the Jirau HPP reservoir is contained to areas which are regularly flooded indicates that there is no major concern that the implementation of the Jirau HPP will change the positive situation. In any case, the monitoring program will allow a constant survey of the different variable and allow that any possible impacts are being detected and addressed (Venturo, 2012; ESBR Relatório Final IBAMA, 2012, LIFE, 2011)

## 4 Comments and questions about social impact and labour issue

This section provides background information and responses to the comments that question issues related to social impacts, with a special focus on the conditions and composition of the workforce.

**Summary of the comments from Fearnside and International Rivers (IR):**

According to Fearnside, Jirau HPP project does not contribute to social development. He questions the affirmation of the PDD that "more than 70% of workers are hired locally". Instead, he affirms that Jirau HPP caused severe social problems due to massive migration of workers to the construction site and surrounding area.

In addition, Fearnside and IR mention that the two incidents of "criminal arson" that occurred at the construction site in 2011 and 2012 are a proof that work conditions are not as good as described in the PDD. According to Fearnside and IR, violations of workers' rights, the lack of fair wages, as well as the bad living and working conditions led to labor unrests.

Furthermore, Fearnside claims that, the Nova Mutum Paraná District was not designed in benefit of the reallocated population, as described in the PDD, but was established as a village for the Project's engineers.

**Background information to our responses:**

The long history of the State of Rondônia and its economic development is characterized by several extractive economic cycles, related to the exploitation of natural resources such as rubber, mining and timber. Until recently, it was also a borderland area where predatory territorial occupation was accompanied by violence due to land disputes, an issue also portrayed in the chapter about deforestation. In this context, the implementation of Jirau HPP provides an important opportunity to improve the existing socioeconomic scenario and increase the level of control and governance, especially in the Project's Direct and Indirect Influence Areas.

The first driver for such a change is the increase of local and regional income generated by job creation and the expansion of economic activity, which enables the inclusion in the consumer market of population segments that were living marginally on a poor subsistence economy and in precarious and informal work conditions.

The observed labor formalization which is taking place as a consequence of Jirau HPP's implementation represents a major social evolution for the region, where the primary sector is of predominant importance and where a significant part of workers are subject to precarious work conditions in rural areas. This benefit is also gradually enjoyed by the work force that is not absorbed by the Project as they benefit from the diffusion of formal work relations and the formalization and regularization of small and medium-size businesses that respond to the demand generated by the ESBR, the construction company and its contractors. This evolution is catalyzed by the fact that all purchase and service contracts established require that the supplier is compliant with federal, state and municipal tax legislations as well as with the rules and norms that regulate social security and labor contributions.

It should also be emphasized that the economic benefit generated by the Project, as opposed to previous informal economic cycles related to the exploration of natural resources, is secured in the long term. The fact is that throughout the concession of HPP Jirau, the city, the state and the federal governments are receiving important resources in form of royalties and taxes which represent an important and continuous economic stimulus. These resources allow the state and the municipality to invest in a gradual and sustained improvement of the population's life quality, providing them formalized economic opportunities.

In addition to that, the construction process and the socio-environmental programs are designed in order to promote the establishment of a sustainable local economy, securing population in rural areas and thus reducing migration to cities, especially young people, as well as to provide a professional upgrade to the local workforce, which will benefit the workers and the region in the long term.

Since the construction of hydroelectric projects requires extensive use of work force with specific and diversified skills, this process has to be planned carefully. When such constructions take place in regions with low population density, as is the Direct Area of Influence of Jirau HPP, the economically active population is not sufficient and not adequately well-trained to supply the work demand, which means that it is necessary to pursue complementary strategies to attract skilled workers from other regions, providing them with adequate support for migration, as well as to offer capacitating courses suitable to qualify a work force from the surrounding areas.

In response to this challenge, ESBR and its contractors have established a detailed strategy for professional capacity of the local workforce, training them with the skills required for formal construction work with the required quality. This training was organized and implemented in the *Sustainable Generation Program*, which is a responsibility of Camargo Corrêa Construções e Comércio, company in charge of the works of Jirau HPP. The program is part of the Population Qualification and Opportunity Development Sub-Program (Social Compensation Program – Item 21 of the Basic Environmental Project) and aims to provide adequate professional capacity to 10,000 local workers. The program started in the initial phase of the Project in 2008. Until May 2012, 7,809 workers had already been trained, which means that 78% of the proposed target has already been achieved. It is important to note that the activities developed within the scope of the Sustainable Generation Program have three orders of synergies which may be characterized as follows:

i) They are closely related to the qualification demands of the population in the Jirau HPP Direct Influence Area ;

ii) They contribute to the dissemination of knowledge and techniques;

iii) They disseminate knowledge and values of great importance in the consolidation of the social leading role of the communities they serve with the example of qualification, environmental education and information and communication technology.

In addition to that, ESBR has been monitoring the impact that its direct and indirect demand for work force had in the region, especially as the nearby Santo Antonio plant already had captured a large quantity of workers. In such a situation it is to be avoided that the demand for construction workers cannibalizes other economic sectors in the region, which see their demand also boosted by the project development. Such analysis also led to the conclusion that it is of advantage to have local population bound in local businesses. As a consequence the target for local contracting was reduced.

In addition to that, and with the objective to provide optimum support to workers that come from other regions, ESBR implemented a Migrant Worker Support Center (CAM), in order to give support to the migrant workers as well as to strengthen the local community and the Project surrounding areas. Some of CAM's activities include:

iv) Survey of migrant workers and their families including professional qualification, work experience, education level and type of work in demand;

v) Disclosure of information on job positions and vacancies, as well as on the profile of professionals in demand to be hired by the Developer and its contractors and other third-party companies;

vi) Labor registration and enrollment for job opportunities in activities not related to the Project;

vii) Referral of migrant workers to companies announcing job vacancies at the Job National System (SINE), system created by the National Labour Secretariat where workers can apply for jobs intermediated by the Agency;

viii) Referral of families in vulnerable situation to the Affected Populations Reallocation Program to social assistance institutions of Porto Velho that operate in the project's Direct Influence Area;

ix) Support to the strategies of demobilization of workers after the construction of the Plant.

With respect to Fearnside and IR's comments that the work and living conditions at the construction site are not appropriate, it is important to highlight that, as mentioned in the PDD, the construction site and the workers lodging facilities provide all the infrastructure required for the workers well being, including air-conditioned lodgings, leisure and recreational areas, canteens, training centers, gym, Internet room, games rooms, TV rooms, barbershop, drugstore, cafeteria, among others, in addition to an appropriate health and transport system. The attractive conditions that are being offered are even being recognized by workforces in other infrastructure projects and are being used as a reference for their requirements. In fact, Jirau HPP was appointed as a model in a workers' strike at Belo Monte HPP in Altamira, Pará State. Workers' demands included triple food allowance and the double frequency of

family visits, as offered to Jirau HPP's construction workers. (Comissão do Trabalho da Câmara quer tratamento igual para operários de grandes hidrelétricas - Agência Brasil, 2012).

The level of comfort offered to the workforce was even recognized by the former Brazilian President Lula, who was for decades one of Brazil's most important syndical leaders as referenced in our Textbox 1:

> *"(...) here at this hydroelectric plant an important thing happened that we don't see in any other plants: the air-conditioned lodgings. This is very important, because it shows that workers are learning to conquer their rights, businessmen are learning that this is important, as the more comfort is offered to workers the more they will produce and this way we will change the face of our country."*

**Textbox 1 Citation President Luiz Inácio Lula da Silva from a speech given at the construction site in August 2010**

With regards to the incidents of civil unrest and "criminal arson" as cited by Fearnside that occurred at Jirau HPP's construction site, it was proven that they were related to criminal action of some individual and not to labor issues. The strike which led to these criminal actions was considered illegal by the Brazilian Labour Justice, and the timing of the strike was close to the annual wage renegotiation period, with several other projects in Brazil also being impacted by strikes. Brazil has rigorous labor legislation, specialized courts, tradition in the mediation and arbitration of these kinds of conflicts, and the authorities led complete investigations which proved that the incidents in the construction site were not caused by labor claims but were criminal actions made by felons from other states of Brazil.

"None of the accusers is from Rondônia. They came to work here. Many of them have been in the works for less than 30 days" (Deputy Hélio Teixeira, Rondoniaovivo, 2011).

"We do not consider what happened there as a union action or a mobilization action, but rather as vandalism, delinquency and gang attitudes and as such they shall be addressed" (Gilberto Carvalho, Minister of the General Secretariat of the Presidency, Exame, 2012).

"The criminal movement shows a persuasive effort to aggregate subjects capable of committing crimes. Furthermore, the false idea of labor claims is a makeup for the gang that imposed their attitude on innocent individuals" (State Prosecutor Rodrigo Leventi Guimarães, MP Rondônia, 2012).

With regards to the population not directly employed by the Project, it's important to emphasize that Jirau HPP works in partnership with local government and NGOs to benefit these population, in order to maximize the positive externalities generated by the increase in economic activity generated by the construction and operation of Jirau HPP. The Population Qualification and Opportunity Development Sub-Program were created with this in mind. It encompasses activities such as capacity and training of local population. An example is the Reintegration Promotion Program, that has trained 275 students in the Jaci-Paraná district as electrical and computing technicians and the Environmental Education Program that offers training and capacity on forest management, seedling production, digital media

and social surveying in workshops developed by Jirau Environment Observatory. The Observatory has also given support to the establishment of a rural producer's cooperative that has already produced and sold 120,000 seedlings to the Recovery of Deforested Areas Program and to the Flora Conservation Program.

Furthermore, Jirau HPP's complex production system attracted a cluster of companies with extremely high productive capacity, which employs modern production technologies and resource management. These companies' human resources sectors operate in absolute respect to the national labor law and will influence and change the existing pattern of work relations in the region.

All these actions contribute to the development and improvement of work conditions and increase employment opportunities in the region and, consequently, a raise in income. In 2011, Jirau HPP employed 23,000 people in three work fronts: the construction site, Nova Mutum Paraná and in the area of the future reservoir.

In addition, in cooperation with municipal and state authorities as well as NGOs, ESBR has been carrying short and long term activities that benefit the population of several towns in the Direct and Indirect Influence Areas of Jirau HPP: construction or refurbishment and re-equipment of public and private schools; management capacity in 32 municipal schools; the creation of a newspaper for 28 schools to improve communication between the school system and the community and the creation of travelling libraries with a collection made of works appointed by the Ministry of Education.

Finally, a compensation agreement between Jirau HPP and Rondônia's state government will transfer R$ 90 million to the state government to be used in the expansion of the penitentiary system; the improvement of the health infrastructure with more beds and new equipment; the construction of new schools; road paving and conservation; bridge construction and other infrastructural works (Portal Rondônia, 2009).

With regards to Fearnside's claim that the Nova Mutum Paraná District benefits only the engineers working on the project, and not the reallocated population, the claim has no grounding since the District already houses 199 families relocated from the poor community of Mutum Paraná and rural areas on the perimeter of Jirau HPP's reservoir. It is important to mention that the houses are donated to the local government after the construction phase. With an investment of R$ 256 million, Nova Mutum Paraná is a complete city with 1,600 houses and all facilities: streets, housing, schools, bus station, police station, churches, cemetery, town hall, store fronts, and all infrastructure enabling families to have a better life quality. Moreover, the construction of the city encourages the creation of new businesses involving local traders and population, the increase and development of local economic activities, long term job generation, local development to keep the population employed after the dam construction, as well as an increase of local life standards.

**Conclusion and responses to the comments from Fearnside and International Rivers:**

ESBR and its contractors are observing the applicable legislation and best practices for training, capacitating, contracting and assisting its work force and maintain several programs that promote the education and economic evolution of the region's population. Next to the economic impulse, which is guided to generate local demand and expansion of legally regulated work opportunities, the training and capacitating measures will empower the local and the migrating workforce and therefore society as a whole.

In line with this concept, Nova Mutum has been founded as a nucleus for sustainable economic development where resettled people are living in together with others that came to establish economic activities that are being incentivized by the Jirau HPP development.

In addition, we have to reiterate that all investigations and testimonials demonstrate that the incidents of "criminal arson" where not related to any labor inadequate conditions, but to effectively criminal action by a reduced number of individuals.

## 5 Comments on possible impacts on Indigenous Groups

This section provides a summary of the comments and the facts about the relation of the Jirau HPP project activity with federal indigenous territories and eventual tribes of isolated Indians and mentions the investigation that is being conducted by the Public Prosecutor's Office.

**Summary of the comments from Fearnside and International Rivers (IR):**

According to International Rivers, the "construction of Jirau HPP has caused social and environmental impacts on federally-protected indigenous territories and on nearby tribes living in voluntary isolation."

**Background information to our responses:**

In fact four federally delimited indigenous territories (Kaxarari, Igarapé Lage, Igarapé Ribeirão and Uru-Eu-Wau-Wau) are covered by the environmental license process of Jirau HPP and, consequently, in the programs and measures for assistance proposed by ESBR. In any case, it is important to observe that there are no indigenous territories in the project's Direct Influence Area (AID); therefore, Jirau HPP will have no direct impacts on them. The indigenous territories included in the environmental license of Jirau HPP are located at a distance of at least 50 km from the reservoir area.

Notwithstanding, ESBR is in permanent contact with FUNAI (Fundação Nacional do Indio), which is the authority in charge of protecting the rights of indigenous populations, to assess all actions being taken. The practice in this regard is that decisions of compensatory measures are to be carried out after being defined and ratified by FUNAI and the indigenous groups involved.

In this sense, an Agreement was signed on Territorial Protection and Surveillance Plans of Indigenous Territories, including support to FUNAI for the protection and surveillance of these territories. Plans cover the construction and equipment of surveillance points; qualification and subsequent hiring of natives for surveillance; donation of equipment and vehicles for services.

In addition to the protection plans, a diagnosis was made to identify projects in the sectors of production, health, education and infrastructure to be developed as community support. The diagnosis was sent to FUNAI for evaluation. This study contributed to the drafting of the Support Program for Indigenous Communities, which was also submitted to FUNAI's appraisal.

FUNAI and ESBR are aware of the possibility that isolated individuals inhabit the region at a distance greater than 40 km from the project, which is now protected by the Mapinguari National Park (PARNA) expansion and for this reason upon issuance of LI No. 621/2009 by IBAMA. FUNAI, in its Technical Opinion No. 07/CGMAM/CGPIMA/2009, requested the implementation of an Emergency Protection and Surveillance Plan for Indigenous Peoples and Territories addressing specific actions referring to isolated individuals among other issues.Such plan defines ESBR as a financing company of interventions that should be performed by FUNAI itself. They include: hiring human resources for FUNAI expeditions to identify isolated Indians; acquiring materials, equipment and vehicles to carry out the expeditions; donating building materials for a support station, and providing maintenance and fuel. These actions are in development as stated in the Plan.

According to information provided by FUNAI, studies conducted for the previous license stage of Jirau HPP did not find isolated individuals in the project's Area of Direct Influence, which means that the presence of isolated natives in the vicinity of the project has not been confirmed.

A Sustainability Committee composed by local and public authorities, affected populations, development and technical teams of our social and environmental programs was created to discuss Jirau HPP initiatives in this field. An Indigenous Working Group conducts discussions on the progress of these initiatives. The Working Group has already organized nine meetings.

**Conclusion and responses to the comments from Fearnside and International Rivers:**

There is no evidence of isolated indigenous tribes in the Area of Direct Influence of the Jirau HPP, but nevertheless ESBR finances an Emergency Protection and Surveillance Plan for Indigenous Peoples and Territories, as defined and implemented by FUNAI. In addition, the consolidation of and expanded Mapinguari National Park which was possible as a consequence of the Jirau HPP offers an increased protected and well conserved federal Conservation Unit with more rigid control and surveillance than the previous state-owned and fragmented conservation units. In case isolated indigenous exist, this measure is of great benefit for their protection.

With regards to the identified indigenous tribes living in distance to the Jirau HPP project activity, no direct impacts are foreseen, but nevertheless sound and effective programs for their support and protection are being established and implemented in close coordination with the FUNAI.

# 6 Comments on Environmental Integrity and Additionality Assessment

This section provides a summary of the comments that question the environmental integrity of the emission reductions generated by the Jirau Hydropower Plant as a CDM project. Many of the criticisms and issues raised question Brazil's energy sector development strategy, the motives behind Brazil's climate change policy and renewable energy incentives, and the governmental bodies responsible for regulation and licensing of energy generation activities. For this reason ESBR, which itself is subject to Brazilian policy and regulation, can only provide general explanations and pertinent views to allow a better understanding of Brazil's governance, priorities and policies. Many other issues raised target rules and principles of the CDM and therefore ESBR again will provide pertinent explanations and views to contribute to a better understanding of the project activity. Nevertheless, the CDM registration process of the Jirau HPP CDM activity will have to follow the rules as set forth by the COP/MOP and the CDM Executive Board, as well as the specific requirements of the Brazilian DNA, and therefore many issues cannot be taken into account for the process.

Other questions and comments, which target the content and explanations of the PDD, will be addressed adequately and where appropriate changes in the PDD will be made.

To allow a transparent and structured treatment, the comments in this chapter were organized in four thematic groups:

a) Conceptual comments regarding the additionality of the Jirau HPP project activity;

b) Comments about treatment of national policies under the E- concept;

c) Comments about investment benchmark and accuracy of the investment analysis

d) Comments and Questions in relation to project emissions

**a) Conceptual comments regarding the additionality of the Jirau HPP project activity.**

**Summary of the comments from Fearnside and International Rivers (IR):**

Both Fearnside (2012) and IR raise doubts about the additionality of the Jirau HPP based on arguments that hydropower is common practice and that the project activity would have been implemented anyway. Fearnside requires showing that the project would not take place without CER revenues and emphasizes the fact that the project is already under construction, and would not stop in case no CER revenues are granted, is a proof of the lack of additionality.

Now in contradiction to the argument that hydropower projects would be implemented anyway, IR and Fearnside emphasize that hydropower projects are being promoted by the government and that they obtain considerable incentives from the Brazilian Development Bank.

For the same reason Fearnside argues that Jirau HPP will not reduce any emissions as the Brazilian policy for clean expansion of the energy system with hydropower will eliminate fossil fuelled plants from the system and thus the energy generated by Jirau will substitute other hydropower and renewable energy plants instead of fossil fuelled generation and therefore not yielding any emission reductions.

In spite of this conclusion, Fearnside is also concerned with the fact that large amounts of money would have to be spend on non material emission reductions (hot air) generated by the Jirau HPP, while IR is concerned that GDF SUEZ (or other European companies) might not be able to use the CERs generated as offsets due to lack of eligibility under the EU ETS.

Finally Fearnside and IR criticise that the CDM is being used to promote unsustainable projects with severe social and environmental impact and that the Jirau HPP CDM project activity is an example for the flaws of the Clean Development Mechanism. In addition to this, Fearnside is of the opinion that that the Brazilian expansion should have been driven on the basis of wind, solar and tidal energies to substitute hydropower.

**Background information to our responses:**

Following we would like to explain that the Jirau project was not only a concrete result of Brazil's national climate change policy with the objective to satisfy the growing energy needs without recurring to fossil fuelled thermal energies, but also allows increasing participation of non conventional renewable energies. In fact, a portfolio of renewable energies is the only possible and sustainable low GHG intensive development option for Brazil and to achieve this, the country has established an ambitious set of policies and domestic investment incentives which consider the CDM as an important support mechanism. We also explain that the volume of certified emission reductions generated by the Jirau Hydropower plant are not only additional, permanent and material, but in fact sub estimate the effective GHG emission reductions achieved by the Jirau HPP project activity.

Now before we enter the discussion, we would like to explain the important role that the CDM has to promote hydropower projects and renewable energies in developing countries in general.

i) <u>The importance of energy and global cooperation for effi[redacted]t GHG emission mitigation</u>

The important role of energy and especially access to electricity in social and human development is widely recognized and evidenced by the relationship between the Human Development Index and specific electricity consumption (IPCC 2011, Figure 9.3, p. 720). In recognition of this relationship, **the critical role of reliable, economically viable and socially and environmentally acceptable energy for sustainable development through poverty reduction and the satisfaction of basic human needs has been emphasised** by the "The Future We Want" declaration (§ 125-129), as agreed in the Rio +20 UNCSD (2012a) conference.

According to the World Energy Outlook (WEO, 2009), the important objective of satisfying the energy demands of a growing global population requires investments of 26 trillion USD by 2030. This equates to about 1.4% of global GDP per year. The power sector requires 53% of this investment to finance the installation of 4800 GW of new generation capacity, mostly in developing countries, which correspond to 90% of global population growth. This is equivalent to 5 times the current installed capacity of the United States and 80% of the investments have to be made in non-OECD countries to allow sufficient economic growth for poverty eradication. The numbers illustrate the significant challenge to finance this unprecedented expansion of energy infrastructure, especially in fast growing emerging economies. The situation is exacerbated by the fact that these figures reflect a business as usual (BAU) trajectory which will lead to temperature increase of more than 6°C. To address the urgent necessity of limiting climate change to a maximum of 2°C an additional USD 10.5 trillion will have to be invested during this period. Again, most of the capital is required in non-OECD countries. WEO (2009) also emphasized that the energy sector's high capital intensity and long asset lifetime make GHG mitigation prohibitively expensive once GHG intensive assets are built. As a consequence, the most recent edition of the WEO (2011) concludes that the technological lock-in, which is taking place in developing countries, will close the door to the 2°C objective if their expansion trajectory is not significantly changed by 2017. Urgent action is required to prevent prohibitive costs in the future and Brazil, on the basis of the National Climate Change Policy which is being developed since 2007, is making significant and promising progress in this direction.

ii) **Climate Change Policy in Brazil: An example of domestic action and global cooperation:**

Though the Brazilian climate change policy is broad and covers all sectors, the energy sector is an outstanding example due to the advanced status and demonstrated effectiveness of the policy. In fact the country is endowed with different renewable energy sources, such as hydropower and wind or even solar and tidal energy and has a privileged position to grow on the basis of existing renewable energy technologies, as long as the right policies are in place. The importance of adequate policies appear in the light of the fact that the country saw a predominantly fossil fuel based expansion since the privatisation in the year 1994 and 2007, year in which Brazil initiated the consolidation of its National Climate Change Policy. In this period (Abbud and Tancredi, 2010) the country effectively installed about 14,000 MW of fossil fuelled electricity generation plants and emissions rose from 10.8 to 24.1 Mio t $CO_2e$. It is further important to know that during this period Brazil had effectively promoted about 3 GW of complementary energies such as wind, biomass and small hydropower (PROINFA) and that it had seen the installation of another 3 GW of new renewable generation capacity on the basis of the CDM. Nevertheless, the development of hydropower in a scale similar to the Jirau hydropower and as necessary to satisfy Brazil's fast growing energy demand did not occur since the government's investment capacity had exhausted in the late 80's. Instead of that and in spite the strong support for non conventional renewable energies, Brazil saw the implementation of significant thermal fossil fuelled generation plants, even in the first years of the new regulatory framework which initiated with the first energy auction in December 2005.

In the light of this fossil fuel based expansion, discussions about the important role of hydropower for clean development started in 2006 (Ambiente Brasil, 2006) when EPE emphasised that sufficient energy to supply growth in demand of 5.2% per year was the key priority of its policy. Further EPE explained that it would be possible to satisfy this demand with thermoelectric power plants, but that the implementation of new run-of-river reservoirs such as the Madeira plants Jirau and Santo Antonio is preferred as they would safe up to 45 Mio $tCO_2$ per year (as calculated against the equivalent emissions of thermal power units). Further **EPE declared that the establishment of incentives for investments in hydroelectricity, biomass and other complementary sources will be, if elected, a priority of the second government as proposed by President Lula.**

After President Lula's election, the issue was also discussed within a mixed commission of representatives of the Senate and Parliament which was founded on 13 March 2007 to discuss Climate Change policy. According to the report (CMEMC, 2008), the swift development and implementation of run-of river hydropower projects is important to satisfy the growing energy without the installation of new fossil fuelled thermal plants. **According to data presented to the committee by Mauricio Tolmasquim, president of EPE, on 28 and 30 of August 2007, without the Madeira plants, GHG emissions would increase significantly as from 2012 as an equivalent in thermal generation capacity would have to be installed.** Though the report also raises the concern that the option for run-of-river power plants without storage area implies the loss of storage capacity, which is important for energy security, the report considers this to be an important measure to minimize environmental impact and thus to make environmental licensing possible. The report also makes reference to the importance of the CDM and to the fact that the BNDES is offering specific credit lines for GHG mitigation projects.

Based on these discussions, Brazil's National Energy Plan 2030 (MME, 2007a) clearly defines the development of Brazil's hydropower potential as fundamental for a clean expansion. **EPE's calculation show that for each 20% less in hydropower developments, emissions would grow by 86 Mio $tCO_2e$ p.a.** The report also discusses the issue of GHG emissions from reservoirs, but concludes that these can be avoided by building run-of-river hydropower plants with small reservoir surface that do not alter the river flow. Furthermore, the report identifies that such hydropower projects are eligible to the CDM, which provides a financial incentive to their implementation.

In parallel to this evolutions, Decree Nº 6.101 of 26 April 2007 gave to the Ministry of Environment (MMA) the new attribution and powers to propose and develop: i) strategies and policies for climate change mitigation and the development of a sustainable energy matrix; ii) to support the development and expansion of environmentally sound energy options and iii) to propose and implement policies for the regulation of carbon market instruments such as the CDM. At the same time IBAMA conducted the public consultation of the Environmental Impact Assessment of the Madeira hydropower plants Jirau and Santo Antonio, which had been defined on the basis of the concept of run-of-river plants with minimal reservoir surface, and which also makes clear reference to the Clean Development Mechanism which *"shall help to make the projects viable"*, and issued the preliminary license on 9 July 2007. The MMA's and IBAMAs efforts to promote the climate change agenda in the area of forest protection, promotion of the CDM and the licensing of the Jirau are also documented by the IBAMA

Statement *"Ações do MMA reforçam combate ao desmatamento e às mudanças climáticas"*, issued on 30 December 2012 (MMA, 2007).

As referenced by the statement, the government believes that its ambitious objectives and actions will not only reduce domestic emissions, but also promote the continuation of the Kyoto Protocol and international ambition for GHG mitigation. In this context the article makes clear reference to several other actions and policies that were implemented or under development at that time. These policies are related to the fact that, in November 2007, the Interministerial Committee for Climate Change with 16 Ministries was founded to define early actions and to develop the law for the development of the National Policy for Climate Change Mitigation as well as a Plan for Mitigation and Adaptation. Following that, on 11 February 2008, and on the basis of the preliminary environmental license issued by IBAMA in July 2007, Jirau was declared project of national interest with priority for tendering and implementation (MME - Resolution N°1, 2008). Shortly after that, on 28 April 2008, the Brazilian Development Bank announced its support policy for financing of the Jirau HPP. The fact that this financing policy is part of the government's objective to promote clean growth of Brazil's energy matrix is not only referenced by the government's clear campaign pledge when running for re-election, as well as by the other references cited above, but also by several documents which describe the National Climate Change Mitigation Policy:

1) As defined in the 10-year expansion plan published by the Ministry for Energy and Mines (MME, 2007b) in December 2007, Jirau is a plant of highest priority and deserves special attention by all relevant governmental entities to promote its implementation (Table 19, page 420). The document explains that expansion with low GHG intensity is one of the key objectives for this policy (page 55).

2) As a result of the work developed by the Interministerial Committee for Climate Change, the National Plan for Climate Change (PNSMC, 2008) was developed and its final draft was posted for public consultation in September 2008. The document makes clear reference to the government's objective to reduce GHG emission growth by incentivizing the development of hydropower and other renewable energies. In fact the emission reductions projected for the implementation of the Jirau HPP are quantified by the document. Furthermore, the BNDES financing conditions are described as a key policy to promote GHG mitigation activities.

3) Law Nº 12.187 which defines the Brazilian Climate Change Policy and was enacted in December 2009, declares that existing and future mechanisms such as: i) preferential tendering and contracting, ii) private public partnerships; iii) preferential financing conditions by private and public Banks, as well as iv) the CDM, are part of the policy tools to promote GHG mitigation activities.

4) The "Letter including nationally appropriate mitigation actions" (Brazil, 2010, translation ours), submitted to the UNFCCC in response to the Copenhagen declares that the *"Increase in energy supply by hydroelectric power plants"* would allow emission reductions in the range of 79 to 99

million tons of $CO_2e$ until 2020. Furthermore, the document is clear that the emission reduction objectives are voluntary in nature and that *"The use of the Clean Development Mechanism established under the Kyoto Protocol is not excluded."*

5) The Decree Nº 7.390, enacted on 9 December 2010 to regulate Law 12.187 revises and increases the voluntary emission reduction objectives of the energy sector and again makes clear reference to hydropower and other renewable energy sources to achieve this target. As a basis for this decree, Brazil's Governmental Energy Research Company EPE (EPE, 2010) had issued a technical paper which was discussed in a public consultation process and which quantifies the contributions of hydroelectricity for emission reductions in 2020 to be 80.7 Mio $tCO_2e$. The paper makes reference to BNDES' financing policy and to the CDM and also documents the governments understanding that the national efforts are to be seen as E-regulations as defined by Annex 3 of EB 22.

The continuation of the government's political commitment with the National Policy for Climate Change and the expansion on the basis of renewable energies with a focus on hydroelectricity as established in the second government of president Lula has again been emphasised Dilma Rousseff in her campaign for the Election in 2010 and her election shows that the government's strategy is endorsed by the majority of Brazil's electorate and thus democratically legitimized (IstoÉ, 2010).

iii) **Hydropower as GHG mitigation technology:**

According to the recent Special Report on Renewable Energies (SRREN) issued by the IPCC (2011), hydropower offers significant potential for emission reduction and for catalysing sustainable development. Unfortunately, its participation in global energy supply has been dropping from 21% in 1973 to 16% in 2008 and this process will continue unless appropriate policies to facilitate financing are being established. **The report clarifies that long construction times, high upfront costs, uncertainties in relation to geological circumstances, difficulties and risks in relation to environmental licensing and thus risks for unexpected cost overruns and delays of completion are key obstacles for project development.** To facilitate project development the report recommends the use of carbon market instruments. **IPCC further presents hydropower as an important complement to wind and other renewable energies and thus a basis for an economic expansion based on clean and renewable sources.**

In order to better understand these statements we would like to specifically discuss the issue of barriers towards hydropower developments, as well as their important role for a low green house gas emitting and cost efficient renewable based energy portfolio.

**iv) Comments on Barrier for hydropower developments:**

The principles of the CDM recognize that barriers can prevent project development, as well as the importance of the CDM to overcome such barriers. Typical barriers are i) Technical Barriers as well as ii) Lack of access to financing.

According to the Additionality Tool (UNFCCC, 2011a), a technical barrier is a "*Risk of technological failure: the process/technology failure risk in the local circumstances is significantly greater than for other technologies that provide services or outputs comparable to those of the proposed CDM project activity, as demonstrated by relevant scientific literature or technology manufacturer information.*" In line with this definition we can define that thermal power plants, which are a commonly observed Business as Usual technology, effectively offer "*services or outputs comparable to those of the proposed CDM project*".

A comparison of the specific risks profile of both energy sources is offered by a specific report issued by the World Bank (2000) which concludes that, in difference to off the shelf thermal power plants which can be installed close to the centre of consumption and without major investments in distribution lines, hydropower plants are site specific projects designed in response to specific local geological and hydrological conditions (World Bank 2000). As a consequence hydropower projects have higher and more uncertain implementation costs when compared to thermal power plants. There is also an increased risk for cost overruns due to unforeseen problems, especially those related to geology. Consequently, the World Bank (2000) states that: ***"The construction cost of hydro is typically 100 to 200 percent more than a thermal power station on a $/kW basis. The gap is magnified by the so-called "soft-costs" which are invariably greater for hydro and include interest over the longer construction period, more burdensome EIA and project preparation requirements, and larger margins to cover the heavier project risks".*** In addition, World Bank (2000) identifies some hydro-specific problems:

a) The need for expensive and time-consuming front-end studies to determine the optimum project parameters;

b) The difficulty of establishing in advance of construction a firm cost and completion date;

c) The need to apportion construction risks in a way that does not unduly inflate the contract price.

Another specific feature of hydropower when compared to thermal power plants is their high operating leverage, where up-front capital costs are high, but operational costs are low. This implies that hydropower plants are prone to government tariff interference or even expropriation, which is one of the reasons why hydropower is difficult build in countries with unstable economic or political environment.

The second common barrier is access to financing. The Additionality Tool defines as credible and realistic investment barrier when *"No private capital is available from domestic or international capital markets due to real or perceived risk associated with investment in the country where the proposed CDM project activity is to be implemented, as demonstrated by the credit rating of the country or other country investment reports of reputed origin."*

In fact this barrier is very frequent, since financing of renewable energies and especially hydropower is in general more challenging than that of thermal power plants, especially in the context of developing countries where capitals is scarce and expensive, and were long term financing is especially difficult to obtain. Following some references that illustrate the fact that there is a general difficulty to finance hydropower investments in many countries, a barrier that does not exist for thermal power:

- The World Bank (2000) provides a detailed discussion how high capital-intensity, high operating leverage, high uncertainty of costs for civil works and long construction and payback times of hydropower make debt financing with the needed long tenders difficult to obtain, especially if there are uncertainties with the long term tariff definition;

- The general fact that "*No private capital is available from domestic or international capital markets due to real or perceived risk associated*" to hydropower projects developed by the private sector, is again evidenced by the World Bank study Financing of Private Hydropower Projects (World Bank, 2000) which concludes that hydropower projects are capital-intensive, slow to implement and risky. As a consequence the report concludes that "*In many markets commercial debt is severely limited in volume, and short maturities combined with high prices make it unattractive.*";

- According to another study developed by the World Bank (2007) "*...liberalization favours power sector investments with short payback periods, while such capital-intensive investments as hydropower [...] are stymied*".

These references evidence the significant difficulties and barriers for hydropower developments and show a specific barrier established by the *Guidelines on Barriers (UNFCCC 2011c).* They clearly show that lack of access to capital in combination with the high and uncertain capital requirement is a general barrier for hydropower investments.

Based on the references sited we can now understand part of the reasons which led to the massive installation of thermal power plants in Brazil since the dismantling of the state owned model in 1995, which occurred because the government was no longer able to fund further capital intensive hydropower projects. Now in the absence of appropriate financing it was also impossible for the private sector to undertake large scale hydropower investments. This only changed when the BNDES decided to specifically support hydropower investments with lower interest rates and extended payback periods. Now even with such financing conditions, the level of revenues during the duration of the loan is critical to a Project's capacity to service interests and amortisation and therefore to raise sufficient financing while satisfying the banks Debt Service Cover Ratios. In this respect the CDM has an important role to play by incrementing the operational cash flow during the tender of the loan and the Jirau HPP is an example for the effectiveness of such a strategy.

**v) <u>Comments on the Environmental Integrity of hydropower generated emission reductions:</u>**

After our comments on the conceptual additionality we would like to address the argument that emission reductions from CDM projects are, at best, climate neutral as the CERs generated will be used to offset other emissions. Based on this concept, the CDM has established a complex and rigorous procedure to ensure environmental integrity on the basis of conservative assumptions and principles. This rigorous additionality assessment effectively avoids any generation of non material emission reductions ("hot air"), but does not consider the broader benefits and unaccounted emission reductions generated by hydropower projects. In this context, it is important to further understand the high quality of CERs generated by renewable energies in general, as well as the fact that these technologies will always lead to net emission reductions in excess to the CERs they are being awarded. Following some arguments to illustrate the fact:

i. Once implemented, the clean infrastructure promoted in developing countries will provide structural long term emission reductions independent of the evolutions of the CDM and the carbon price. This feature is an important difference when compared to the emission reductions achieved in the EU ETS (or in other emerging Cap & Trade Schemes of mature markets) which are mostly related to operational decisions that lead to the dispatch of natural gas instead of coal and thus emissions rise again when the carbon price falls. In fact, such operational emission reductions are pure expenses and not related to investments which swift the economy to a clean development trajectory;

ii. The installation of new hydropower generation capacity with its long operational lifetime in developing countries substitutes the installation of the equivalent capacity of long term GHG intensive assets which is the default option in any given year. These GHG intensive assets installed under the baseline scenario will operate for much more than the 21 years which represent the maximum CDM crediting period;

iii. The grid emission factor as it is calculated on the basis of the existing methodologies, sub-estimates baseline emissions as it considers only direct emissions of fossil-fuelled generation and neglects the significant life-cycle emissions generated from production and transport of coal, oil and gas, as illustrated by IPCC (2011) Figure 9.8, page 732;

iv. Renewable energies offer a portfolio effect as the uncorrelated generation variability of different sources leads to increasing diversification and thus energy security and then reduced necessity for complementary or precautionary dispatch of thermal generation. The emission reductions that are obtained from this portfolio effect are not being contemplated by the existing CDM methodologies. Of highest relevance for this effect is hydropower as it is complementing the more volatile wind generation and thus the combination of sources allows emission reductions above those calculated based on the grid emission factor;

v. The reduction of the global cost of mitigation is vital for enhanced ambition and a global flexible mechanism is crucial for economic efficiency and increased scale in renewable energy

development. This will lead to technological spill-over, which will further reduce cost and enhance mitigation.

Thus, the criticism that CDM as an offset mechanism is at best climate neutral or generating hot air is misguided for the case of renewable energies where the CDM leads to net emission reductions in the long term, which exceed any applicable crediting period. This effect is further enhanced by the increasing national support policies which are being adopted by developing countries in the context of their NAMA policies. In synergy with the CDM, such policies can trigger more ambitious emission reduction activities, which would not have been viable on the back of the CDM alone and thus have a high degree of additionality. In turn, the CDM can effectively promote increasing ambition by all parties and add essential elements such as MRV (Monitoring, Reporting and Verification), as well as a transparent discussion of baseline determination and the mechanisms of national mitigation policies.

**vi) Comments on the costs and circumstances for the implementation of a clean energy matrix:**

In fact, the investment analysis as required under the CDM only looks at the costs that arise in the project parameter and that impact the project's financial performance from the investor's point of view. Now to understand the broader role of hydropower for clean expansion and sustainable development of developing countries, as well as the global climate equilibrium, we also have to analyse the broader picture which has to be considered by developing economies.

As mentioned before, to promote that developing countries pursue economic growth on the basis of a mix of mature renewable energy technologies as a substitute to the fossil fuel based thermal BAU trajectory is paramount to address global climate change. According to IPCC (2011) this challenge can be met by introducing the same economically efficient carbon price in all regions, while still taking into account regional specific factors, such as technology, economic growth and population. To understand the perspective of developing countries such as Brazil, the following topics are of importance:

0. Energy security is an overriding priority and the challenge is to ensure constant growth of generation capacity year by year to avoid constraints on their economic development. Any delay or barrier to renewable options therefore will lead to the installation of long term GHG intensive generation assets;

1. Fossil-fuelled thermal energies are the default option for capacity expansion because they can be readily and quickly deployed, are reliable, and their cost is diluted over many years while GHG emissions at plant and for fuel production are not being accounted for;

2. Like hydropower, non conventional renewable energies such as solar or wind require large upfront capital investments and offer a low capacity factor. In addition, the intermittent nature of their generation implies additional cost for their integration into the system, which is referred to as Adequacy Cost, Balancing Cost and Grid Integration Cost[2]. According to the International

[2] All these costs are a consequence of lower capacity factor and intermitting generation profile of renewable energies. Adequacy Cost means that excessive firm generation capacity must be available to meet peak demand.

Energy Agency (WEO, 2011, Box 5.1, page 161) these additional system costs are between 5 and 25 USD/MWh;

3. In addition to large capital demand, renewable energies, including hydropower, still have a higher Levelized Cost of Energy (IPCC 2011, p 750) especially if the cited integration costs are taken into account. To minimize these costs, renewable energies can only be an alternative if applied as an efficient portfolio solution and hydropower has a crucial role for balancing other renewable energies;

4. Clean energy investments require transfer and adaptation of renewable energy technologies as well as experiences with operation and integration of the projects into existing grid systems. Innovation therefore does not only require new technologies, but also the development of solutions to cope with the specific challenges of operating and financing intermittent generation technologies, including hydropower;

5. Successful growth of renewable energies, including hydropower, requires a stable and economically healthy sector to offer engineering, financing, and equipment supply, construction, and operation services. To ensure successful implementation, careful long-term planning and interaction between different policies to overcome technical, socio-environmental and financial barriers is required. While fossil fuelled thermal plants and solutions are readily available 'off the shelf', renewable energies depend on variable and site specific natural resources and have to be carefully designed and adjusted to meet the specific characteristics of their location as well as broader portfolio effects;

6. The identification and promotion of cost effective mitigation options is not only the fundamental objective of the CDM. It is also a necessary criterion towards achieving the objective of sustainable development. Excessively expensive solutions are not conducive to sustainable development nor will they be capable of substituting the observed expansion of fossil-fuelled generation technologies.

These principles have to be understood to shape policies that allow maximizing the use of renewable energies in the short term. The CDM as one of the flexible mechanisms of the Kyoto Protocol has been established to identify and promote cost effective GHG emission reductions in developing countries and to contribute to their sustainable development. Now based on the principle of common but differentiated responsibilities, only developed (Annex I) countries have quantitative emission reduction targets while developing may benefit from generating and selling emission reduction to finance their clean development. In this respect the use of the CDM for financing a balanced portfolio of renewable energies is the ideal case as they allow sustainable development as well as cost effectiveness, yet material and additional emission reductions in the long term.

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Balancing costs refer to the increased necessity to match supply and demand, and Grid Integration Cost refers to the necessity to reinforce the transmission system and to connect remote renewable energy sources. An efficient portfolio of renewable energies may reduce this cost and especially hydropower with temporary storage and flexibility or reservoir capacity has an important role to play.

vii) **The cost of hydropower and other renewable energies and sustainable development:**

As mentioned before, access to affordable, reliable and environmentally acceptable energy is key for human and sustainable development. Likewise, GHG mitigation is fundamental to environmental and economic sustainability. Renewable energies, with their ability to decouple growth of welfare from growth of emission, have a major contribution to make.

Now to adequately discuss the sustainability of renewable energies, the IPCC (2011) chapter 9 *Renewable Energies in the Context of Sustainable Development* explains that **the higher cost of renewable energies is a burden to government and household budgets and might endanger the development prospects of industrializing countries.** This is of special relevance due to the typically high upfront cost of renewable energies, as well as the cost for their integration into the energy system which are a consequence of their generation variability. To limit these negative impacts of a renewable development path for developing countries, the report identifies two important principles:

- **Any constraint in the options for using renewable technologies would further increase the cost of mitigation and is therefore counterproductive for sustainable development (p. 749);**
- The key opportunity and objective is to enable a broad implementation of carbon free technologies in developing countries to leapfrog a BAU expansion based on thermal energies (p 750). According to the report this can be met on the basis of a combination of national and international policies, and the concept of burden sharing agreements.

In consideration of the cited principles the report concludes that *"carbon finance is expected to play a crucial role in providing the funding required for large-scale adoption of renewable energies".*

In the context of the discussion about the development of the most sustainable energy matrix, hydropower has an important role to play as it i) is capable to generate clean and renewable energy with low life-cycle emissions and high energy payback for many decades ii) allows expansion of complementary renewable energies and minimizing their grid integration cost and iii) is capable to generate broader social and environmental benefits.

A clear indicator of these facts is the strong correlation betwe[redacted] country's economic development and the degree in which it uses its hydropower potential. Accordingly, developed countries such as France (100%), Germany (83%), as well as the US, Norway, and Japan (60%) and Sweden (55%) have developed a high degree of their hydropower potential, while South America has developed less than 25% and Africa less than 9% (MME, 2007a). These numbers do not only show the important economic benefit that developed countries have obtained from hydropower, but also the potential and central role that hydropower could play for the clean sustainable economic development of many of the developing countries. In addition, these numbers indicate that hydropower developments are not the first and dominant option and that the diverse barriers for its development are high and often prohibitive for developing countries.

On top of these barriers we observe a constant improvement in the mitigation and compensation of local environmental impact, also on the basis of international pressure and mechanisms such as the CDM. Though this is in principle welcome, it also implies increasing costs and often projects are optimized in a way which reduces energy output in the benefit of lower environmental impact, as it is the case of the Jirau HPP. Though such minimisation and internalisation of local environmental impacts is to be praised, it also requires that global and local benefits of hydropower are adequately remunerated. Otherwise a single sided internalisation of external costs without remuneration of the benefits will increasingly hamper hydropower developments by loss of competitiveness and give way to fossil fuelled thermal plants which are not held liable for their external costs.

**Conclusion and responses to the comments from Fearnside and International Rivers:**

1) The Jirau HPP cannot be seen as common practice because a comparable project has never been developed by the private sector in Brazil. In addition, the project is also different from any plant build by the Brazilian state in the 70's and 80's as it was designed to have minimal environmental impacts on the basis of a pure run-of-river concept with reduced reservoir and no alteration of the river's natural flow. It was further shown that the project could only be made viable by the synergetic combination of national incentives and the CDM where the CDM provides additional income to service a loan which was designed to offer low interest rates and long payback period as necessary to make the Jirau HPP investment viable;

2) The important and innovative support policies as recognized by Fearnside, IR and even industry association that promote fossil fuel generation as necessary to implement the Jirau HPP in fact also illustrate that the project activity cannot be common practice and happen "all by itself";

3) Fearnside's argument that the project implementation would not stop if no CERs would be awarded is a major concern as it illustrates one of the key risks that hamper hydropower plant developments. Once the large implementation costs have been disbursed hydropower plants offer their benefits such as electricity and emission reductions for a relatively low operational cost, but if this is taken as an argument not to remunerate the investment made this would be a very negative signal for future hydropower developments. In the case of the Jirau HPP the situation is even more critical as part of the loan financing is related to CER income and thus part of the project financing would be in jeopardy;

4) Fearnside is concerned that large sum of moneys would be spend on non-material emission reductions generated by the Jirau hydropower plant and at the same time he is concerned that the energy generated by Jirau would substitute other hydropower and renewable energy as being promoted by the Brazilian Government. In fact here he recognizes the effectiveness of the Brazilian policy and on the other hand flags a risk for the CER revenues of the Jirau HPP. As the operational margin is calculated ex post, Jirau will generate less and less emission reductions and carbon related revenues as the Brazilian policy for a clean energy expansion

advances. This show how the CDM is effectively contributing for the transformation of en energy sector and that the resulting emission reductions are related to structural change. Such investment, from a global perspective is to be preferred than the expenditures to achieve emission reductions from fuel switching in mature markets. Even when carbon revenues reduce or go to zero after the full crediting period, Jirau HPP CDM project will continue to effectively generate clean energy and global GHG reduction without being remunerated for it;

5) IR is concerned that the Jirau CERs would not be eligible as offsets in Europe in case the project is not awarded with an LoA from any European member state. Though this is not related to the CDM, the PPs are aware of the situation and will take all necessary action;

6) To accuse the Jirau HPP of being non sustainable implies that a combination of thermal energies with non conventional energies is seen as a more sustainable option and it ignores the important benefits that the project has for the environmental protection and the development of a sustainable economy in its surroundings. In any case, the decision about promoting the implementation of the Jirau HPP was taken by the Brazilian government and the environmental licensing is a responsibility of its regulatory bodies. Likewise, the decision if it contributes to sustainable development will be a sovereign right of the Brazilian DNA when deciding about the issuance of the Host country letter of approval. Nevertheless, we would like to highlight that hydropower is fundamental to assure that a portfolio of renewable energies can provide clean expansion and energy security at moderate cost which supports Brazil's sustainable economic development.

**b) Comments about applicability and treatment of national policies as E- policies**

**Summary of the comments from Fearnside and International Rivers (IR):**

Both Fearnside and IR agree that the financial incentives provided by the BNDES are fundamental for the project's financial viability and they recognize that the Brazilian Government has a policy to promote hydropower and other renewable energies for the expansion of the Brazilian energy supply.

Now interestingly Fearnside and IR do not agree how such policies should be treated under the CDM. As referenced by the textbox , Fearnside understands that the CDM allows calculating the projects investment return without the effects of government incentives, but he insists that it was important to be sure that these incentives effectively pursue the promotion of GHG mitigation and have not been established to meet other objectives.

In contrast to Fearnside, IR acknowledges that *"BNDES operates as a national bank, not private, and offers preferential credit lines for renewable energy projects, which should be considered as governmental subsidies when compared with lending for conventional energy projects."* Now in spite of this recognition IR also states: *"we believe that it is wrong to conduct an equity IRR analysis excluding this record of fiscal benefits."* In fact IR seems to be of the opinion that the provisions of Annex 3, EB 22 have been eliminated by decisions taken at EB 55, where the EB *"agreed not to continue the*

*consideration of the treatment of national and sectoral policies in the demonstration and assessment of additionality"* and that *"the possible impact of national and sectoral policies in the demonstration and assessment of additionality shall be assessed on a case* by case basis." (EB 55, paragraph 27). In addition, IR requests, in reference to Annex 32, EB 53, that the *DOE should assess whether the tariff has been affected by any national and/or sectoral policy".*

In addition to these conceptual issues, IR also makes reference to an additional credit line which ESBR has been negotiating for the financing of the Jirau HPP expansion from the Basic Project design with 46 turbines to the Optimized Project design with 50 turbines.

*"CDM regulations permit using an IRR benchmark calculated from a scenario without government subsidies or other favorable regulations that are designed to reduce emissions. The question of whether the subsidies the dam receives are motivated by climate concerns is therefore critical. Hydro receives favorable financing terms from BNDES, including both lower interest rates (partly from a 2007 change in BNDES policy to offer large hydro projects rates calculated from a "basic spread" of only 0.5%, versus 1.8% for fossil fuels: p. 47) and a provision in effect since 2006 for a 20-year amortization period, as compared to 14 years for gas-fired power plants (p. 48). It is ironic that the 0.5% "basic spread" value charged to large hydro is much lower than the 0.9% charged to wind power (p. 47), raising doubt as to whether the generous concession to hydro is really motivated by climate-mitigation concerns."*

**Textbox 2: Fearnside comments on the treatment of governmental investment incentives**

**Background information to our responses:**

Based on the information provided in the PDD, as well as in consideration of the additional arguments and references offered above, it is shown that Brazil effectively has established a policy to promote the licensing, long term energy contracting and financing of hydropower and other renewable energies, that the BNDES has a key role with offering reduced interest rates and longer payback periods and that the policy development started during the year 2007 and was in place in 2008. We understand that this is recognized by Fearnside and IR, but that they have doubts about the adequate treatment of such national mitigation policies under the CDM. Fearnside is of the opinion that only policies which explicitly seek GHG mitigation may be excluded from the additionality analysis, while IR believes that such adjustments are not appropriate at all.

In fact the discussion about the adequate treatment of national policies that promote renewable energies and emission reduction technologies started at CMP1 in Marrakech. Now with the evolution of NAMAs, national support policies for renewable energies are gaining a vital role for the effectiveness of the CDM to support non Annex I countries in their ambition to pursue the objectives of the UNFCCC. In this context, the concept of E- Policies[3] as defined by Annex 3 of CDM Executive

[3] The regulation also identifies E+ policies as those that provide a comparative advantage to GHG emission intensive technologies, such as fossil fuel subsidies. These need to be ignored if established after 1997, but no such policy has been identified in Brazil.

Board Report 22 (Annex 3, EB 22) is key to adequately treat national mitigation policies under the CDM, to promote such policies, as well as to add the important element of MRV to assure that they achieve real, material and quantifiable emission reductions. Since many national policies also include financial incentives, their adequate treatment under the investment analysis paramount. To achieve this, the Additionality Tool[4] and the Combined Tool[5] make clear reference to the E- decisions (CDM EB 22). They allow the project developer to exclude specific subsidies and incentives from the investment analysis. In order to emphasize the importance of this concept, especially under consideration of the implications that the Copenhagen accord has for the development of national mitigation policies of developing countries, the issue was also addressed at the 15th Conference of the Parties (CMP15, in Copenhagen). This resulted in the formulation of clear guidelines to the CDM Executive Board (UNFCCC, 2009):

§10 *Affirms that it is the prerogative of the host country to decide on the design and implementation of policies to promote or give competitive advantage to low greenhouse gas emitting fuels or technologies;*

§11 *Requests the Executive Board to ensure that its rules and guidelines related to the introduction or implementation of the policies referred to in paragraph 10 above promote the achievement of the ultimate objective of the Convention and do not create perverse incentives for emission reduction efforts.*

Based on these instructions, the Executive Board effectively discussed the possibility to establish more specific guidelines, but in the light of the fact that versatility of possible approaches which arises from the fact that "*it is the prerogative of the host country to decide on the design and implementation of policies*" a general rule was considered to be inadequate and the EB agreed not to detail the provisions of Annex 3 EB 22 and that "possible impacts of national and sectoral policies in the demonstration and assessment of additionality shall be assessed on a case by case basis"[6].

Nevertheless the adequate treatment of national policies has been further detailed by the recent CDM Validation and Verification Standard - VVS (Version 02.0), which was issued as Annex 4 of EB 65 (2012). Paragraph 93 of the document explicitly requires the DOE to determine *"that all applicable CDM requirements have been taken into account in the identification of the baseline scenario for the proposed project activity, as well as relevant national and/or sectoral policies and circumstances, such*

[4] The "Tool for the demonstration and assessment of additionality (Version 06.0.0)" defines that for investment analysis "*all relevant costs and revenues (excluding CER revenues, but possibly including inter alia subsidies/fiscal incentives) shall be taken into account*" and Footnote 11 clarifies that the *"EB guidance on the consideration of national/local/sectoral policies and measures for the baseline setting"* shall be taken into account.

[5] Footnote 11 of the "Combined tool to identify the baseline scenario and demonstrate additionality" (Version 04.0.0)" defines that "*Note that according to guidance by the EB (EB 22, Annex 3), subsidies and incentives may be excluded from consideration in certain cases*. Available from: http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v6.0.0.pdf.

[6] EB 55, para 27.

*as sectoral reform initiatives, local fuel availability, power sector expansion plans, and the economic situation in the project sector".*

In addition, with regards to E- policies, the VVS defined that:

*"National and/or **sectoral policies or regulations that give comparative advantages to less emissions-intensive technologies over more emissions-intensive technologies (e.g. public subsidies to promote the diffusion of renewable energy** or to finance energy efficiency programmes), otherwise known as policies that decrease GHG emissions, **are called type E-.** For this type of national and/or sectoral policies or regulations, those that have been implemented since the adoption by the COP of the CDM M&P (decision 17/CP.7, 11 November 2001) **need not be taken into account in identifying a baseline scenario (i.e. the baseline scenario could refer to a hypothetical situation without the national and/or sectoral policies or regulations being in place)".***

Based on this provision, the Jirau PDD and its additionality section has been developed in the most transparent way possible in order to clarify and quantify all support policies granted to the project activity. As a result, two kind of support policies have been identified:

0. Generic support policies that do not provide any comparative advantage when compared to GHG intensive technologies and thus do not classify as E- policies. These policies imply a reduced payment of income tax and have been fully and transparently described in the PDD and taken into account for the investment analysis;

1. Support policies which provide a comparative advantage to the implementation of the project activity when compared to more GHG intensive alternatives and which have been implemented after 11 November 2001 and therefore classify as E- policies. For their treatment and in line with paragraph 93 of the VVS a hypothetical situation without the comparative advantage created by the national or sectoral policies has been taken into account to evaluate the project activity under the baseline scenario.

In relation to IR request, in reference to Annex 32, EB 53, that the *DOE should assess whether the tariff has been affected by any national and/or sectoral policy",* it is important to understand that Brazil does not regulate tariffs, but offers energy sales contracts under competitive purchase tenders. In the case of the Jirau HPP, 70% of the energy has been old under such a tender and the project has been awarded with a 30 year long energy sales contract, which was an important measure to make the project bankable and therefore viable. Another 30% of the energy is being sold on the free market, where also no government interference on prices exists. Therefore, as Brazil's policy focuses on reduction of the financing cost of renewable in comparison to GHG intensive fossil fuelled thermal power generation assets, there is a clear comparative advantage for investments in such renewable energy projects, while tariffs are a result of free competition.

With regards to Fearnside argument that the promotional policy for hydropower has other objectives that reducing GHG emissions and would have been promoted by specific interest groups it is

interesting to recognize that the incentives and the comparative advantage for hydro and other renewable are in fact being opposed by industry associations which promotes the use of coal for energy generation. In a Press release from 14 December 2010, the Brazilian Association for Mineral Coal (ABCM, 2010) states: *"Few know, but in 2008, the Brazilian Development Bank progressed in its policy to promote a "clean" expansion of the energy supply: it reduced the basic "spread" applicable to large scale hydropower plants to 0,5% and for other energies with low GHG intensity to 0,9% and increased to 1.8% the rate applied for thermal coal and fuel oil fired thermal plants".* In the remainder of the article the association argues that the high capital intensity of renewable energy projects and the high cost of such incentives would not be appropriate in the context of a developing country like Brazil where 30 million people need to be lifted out of misery and that all forms of energy, including national coal need to be contemplated for the countries development. Though the ABMC obviously questions the high cost that these policies have for the Brazilian society, the article allows us to conclude that the Brazilian Development's policy for promotion of renewable energies has been effective to reduce the expansion of fossil fuel fired alternatives and was established against the interest of industries that seek to promote coal fired generation alternatives.

In relation to the question why the spread for hydropower is lower than for other renewable energies, the response is related to the fact that hydropower plants are more sensitive to interest rates due to their long construction time. While wind projects can be operational in 18 months, large hydropower plants take up to 5 years or more to be completed. This leads to high cost for interests during construction, which is one of the main barriers for hydropower developments as cited before. In consideration of this fact, the World Bank (2000) recommends *"the availability of longer-term finance at low cost".* In line with this recommendation the BNDES provided a statement to clarify the background of its policy:

*"On the basis of a differentiation in basic spread, the extension of the financing duration, next to the increased participation in financing, it was possible to reduce the financial cost of hydropower investments to a level which granted them with competitiveness in relation to the financial cost of coal and fuel oil based generation plants"(BNDES, 2012, translation ours).*

Finally we would like to clarify CER revenues have been contemplated as revenues for obtaining the loan from the BNDES, which illustrates the importance of the CDM to contribute to overcoming the barriers related to its high capital intensity and the consecutive lack of access to appropriate financing.

**Conclusion and responses to the comments from Fearnside and International Rivers:**

- In fact Annex 3, EB 22 defines an E- policy only on the basis of the fact that a comparative advantage has been identified *to less emissions-intensive technologies over more emissions-intensive technologies (e.g. public subsidies to promote the diffusion of renewable energy)* and therefore it is not of relevance if the policy was established with the explicitly objective to mitigate GHG emissions. In any case, it has been shown on the basis of numerous governmental documents and references that the implementation of the Jirau HPP and other

renewable energies investments since 2008 are effectively related to Brazils National Climate Change Mitigation Policy. Further it was shows that the support policies defined by the government were important for the project's licensing and financial viability and that that CDM revenues have been consistently considered not only by the investor, but also by the government when planning, licensing and financing the project activity;

- The PDD was developed on the basis of Annex 03 of EB 22 and contains a detailed analysis of all *"relevant national and/or sectoral policies and circumstances, such as sectoral reform initiatives, local fuel availability, power sector expansion plans, and the economic situation in the project sector"* has been offered. Incentives which represent a comparative advantage to the implementation of the Project Activity have been identified and a hypothetical baseline without these policies has been established. Other incentives, which do not represent a comparative advantage when compared to GHG intensive technologies, have been fully considered in the baseline and investment analysis;

- In relation to Fearnside accusation that the *"The PDD fails to mention the massive subsidy in public funding that Jirau receives from a non- Annex I party, namely Brazil"* we believe that there is a misinterpretation of the CDM rules. In fact Fearnside correctly identified the investment incentives offered by the BNDES on the basis of the PDD that was presented for GSC, but he seems to understand that it would be necessary to include this in section A.5. and Appendix 2 of the PDD. Now according to Annex 8, EB 66 (2012), the requirement is to *"Indicate whether the project activity receives public funding from Parties included in Annex I"*. As Brazil is not an Annex I party the PPs understand that it would be wrong to make reference to the fact that Brazil is financing the project activity. In any case this fact has been adequately highlighted in other sections of the PDD.

In conclusion we hope that our comments were able to address the doubts and questions raised by the submission received.

**c) Comments on investment benchmark and accuracy of the investment analysis**

**Summary of the comments from Fearnside and International Rivers:**

Both Fearnside and the IHA criticise the benchmark used to for the demonstration of additionality. Fearnside says that the investor is free to choose any suitable higher benchmark and that *"the values appear to be essentially picked out of a hat"* and constructed on arbitrarily chosen variables and correction factors. IR declares that the CAPM used by the PP is obscure and *"does not accurately represent the actual hurdle rate of investors"*. In addition, both IR and Fearnside compare the benchmark used in the Jirau PDD with those used by other Project activities and argue that the benchmark used in the Jirau PDD is significantly higher. Furthermore, Fearnside also criticises the reference of the World Bank, which was used as comparator by the PP, not to be a credible reference. In complementation to this criticism, IR also cites investor announcements made by GDFSUEZ at the

time of the project starting date which declare that the projected return for the project is estimated to be about 12%, depending on the final Capex estimate and installation chronogram. As a consequence IR requests that the hurdle rate of the BNDES should be applied, rather than an equity investor specific benchmark.

Complementary to the doubts about the benchmark, IR also questions that the investment comparison including the E- policy is only being conducted with the "Base Case", which is the plant configuration that was considered at the project starting date, and not with the "Optimized Project" which is effectively being implemented. The argument made by IR is that the IRR return of the Optimized Project and under full consideration of the Brazilian Development Bank incentives would be higher than the benchmarks used by other comparable CDM projects and thus the project would show to be non additional.

**Background information to our responses:**

First we would wish to clarify that the benchmark used in the Jirau HPP PDD as calculated with the Capital Asset Pricing Model (CAPM) represents the cost of equity (Ke) in real terms as calculated for the project starting date. Investment Analysis and benchmark have been defined in line with the "Tool for the demonstration and assessment of additionality", here referred to as the *Additionality Tool* (Annex 21, EB65, 2011) and the "Guidelines on the assessment of investment analysis" here referred to as the *IA Guidelines* (Annex 5, EB62, 2011).

Therefore the benchmark calculated for the Jirau HPP is not comparable with the Weighted Average Cost of Capital (WACC) used by the Teles Pires Hydropower Plant Project Activity or the Santo Antonio Hydropower Project. The WACC used in the PDDs of the cited projects is an adequate benchmark to judge the return from the perspective of a project as a whole, while the Cost of Equity (Ke) is adequate to judge the return as calculated for the shareholder capital, i.e. the return on the share of project financed by equity and after full consideration of the debt financing, amortisation and interest payments. According to Guidance 12 of the IA Guidelines, both strategies are accepted, but it is important to compare like for like to avoid wrong conclusions.

Now as the WACC is calculated on the basis of the Cost of Equity (Ke) and the Cost of Debt it is possible to compare the Ke value calculated for the Jirau HPP with that used by the other project activities. As referenced by page 14 of the PDD for Santo Antonio, a Ke of 17.31% in real terms has been calculated. As the project starting date of the Santo Antonio project activity is about a year before the Jirau project activity, values are not directly comparable, but the benchmark was calculated to be in the same range of Jirau's Project Specific Benchmark..

In the case of the Teles Pires project activity, page 15 of the PDD indicates that the cost of equity was calculated to be 12.46% in real terms. Again this is not directly comparable as the project starting date of the Teles Pires project is in August 2011, more than three years after the project starting date of the Jirau CDM project activity.

In addition it is important to recognize that the Teles Pires projects considers a default financing rate of 50%, while the Project Specific Benchmark as calculated for the Jirau HPP considers a leverage of 70% as estimated at the time of the project starting date based on the indicative conditions published by the BNDES in April 2008. This project specific variable is also in line with the Feasibility Study Report which was submitted to the BNDES as basis for the project financing and compatible with the final figure finally agreed with in the loan agreement (68,5%).

Now as the increased leverage is effectively part of Brazilian Development Bank's investment incentives, it is part of the E- policy as discussed above. As a consequence the DOE requested to revise the benchmark to also reflect the baseline conditions which were defined for the additionality assessment, i.e. to adopt a standard leverage of 50% as offered for GHG intensive generation sources and which ignore the comparative advantage offered by the BNDES. Moreover, the use of a 50% default leverage is also in line with the Guidance 18 of the IA guidelines. PPs agree to this interpretation of the CDM rules and the Standard Benchmark for Baseline Conditions of 12,46% has been calculated and defined as appropriate additionality criteria of the equity IRR as calculated under baseline conditions, i.e. with a leverage of 50%. This value is now, as a matter of coincidence, exactly identical to the figure adopted by the Telles Pires Project. The PDD has been amended accordingly and the Project Specific Benchmark of 16,05% is only being used to illustrate how the investment incentives and the CDM contribute to make the project activity viable under the specific financial leverage conditions offered by the Brazilian Development Bank.

As a consequence of this simple correction and the applicable comparison we hope to have solved the doubt about any perceived conflict of the approach taken in the Jirau HPP PDD and other project activities. In fact the investment analysis for the Jirau HPP follows Guidance 10 of the Investment Analysis Guidelines, which means that the return on the Jirau HPP equity investment has been calculated after full consideration of the debt financing, amortisation and interest payments. Also, the calculation of the benchmark is based on parameters that are standard in the market and does not consider subjective profit expectations of any particular investor, as required by Guidance 13. This is further regulated by Guidance 15, which allows defining the cost of equity on the basis of simple default values offered by the IA Guidelines (and which will be discussed below), *"or by calculating the cost of equity using best financial practices, based on data sources which can be clearly validated by the DOE, while properly justifying all underlying factors"*. Moreover now Gudiance 18 is being observed and a default leverage of 50% has been applied, which is in line with the standard financing conditions which the BNFDES offers to GHG intensive generation technologies. Based on these options and guidance and after due validation by the DOE a Standard Benchmark for Baseline Conditions of 12.46% has been defined as additionality criteria under baseline conditions, while a slightly corrected Project Specific Benchmark of 16,05% is only used to illustrate the importance of the BNDES incentives and the CDM to reach the project specific cost of equity.

To better understand the concepts behind the CDM rules which guide investment analysis and the definition of an investment benchmark, it is important to consider the fundaments of the financial theory and for reference we indicate Brealey and Myers (2003), Copeland, Koller and Murrin (2002)

and Damodaran (2002). The fundamental premise of financial theory and practice is the positive relation between the risk profile of an investment activity and the expected return. In the case of the Capital Asset Pricing Model, which is the most commonly used tool for the definition of the cost of equity, the return is directly proportional to the non diversifiable market risk of a specific investment activity. This proportionality is given by the Security Market Line. This follows the simple idea that any investor can simply buy and sell capital market instruments according to his risk profile and then gain the financial return which corresponds to the chosen allocation. Based on this premise, the minimum return for an investment activity is therefore defined as the opportunity cost of the funds, i.e. the yield which could be obtained by investing the money on the capital markets at a risk which is equivalent to the risk of the project activity. In other words, if a project yields a return which is equivalent to this opportunity cost, the investor should be indifferent to invest or not to invest in the project. Now as all market parameters fluctuate and evolve constantly, this opportunity costs is time depending and therefore has to be calculated at any specific point in time. This theory has been adopted by the CDM, which requires that the benchmark is to be defined by parameters that are standard in the market at the time of the project starting date.

According to Rocha (2006), who offers and excellent and very didactic introduction to the issue from the Brazilian perspective, the CAPM is the standard methodology to estimate the cost of equity, also for the purpose of regulation and it is used in countries like the UK, Australia, the US, Spain, Argentina and Chile. Now in the case of Brazil, the power generation sector is not regulated, but based on free competition and therefore a governmentally defined hurdle rate does not exist. In contrast, the electricity distribution business is regulated and the government does calculate and define the appropriate hurdle rate and the result can serve as a comparator. The economic rationale used by the regulator ANEEL, together with the applicable financial theory, is explained in detail by a technical note issued in March 2007 (ANEEL, 2007). This technical note and the values are result of a broad public consultation process and the value was defined to calculate distribution tariffs for the years 2007-2009 and therefore was valid at the time of the Jirau HPP project starting date. Nevertheless, as the variables and calculations represent the situation about 15 month before the project starting date the numbers are not completely compatible. In addition, ANEEL calculated the expected return on equity for the distribution business, which has a different risk profile than the generation business. For these reasons, both values are not directly comparable, but they obviously allow comparing and validating the approach taken in the Jirau HPP PDD.

As can be seen from the reference, the expected return on equity invested in the distribution sector is 13.75% and thus broadly comparable to the Standard Benchmark for Baseline Conditions (12,46%), or the Project Specific Benchmark (16,05%) as calculated for the Jirau HPP project activity. Differences are mainly explained by the different assumptions for financial leverage, which is assumed to be 50% in the case of Jirau's Standard Benchmark for Baseline Conditions and 70% in the vase of the Project Specific Benchmark, , versus a 57% average in the distribution sector. Another difference is that the beta for the distribution sector, which has regulated returns, is slightly lower that the beta of generation activities. In addition to that, ANEEL makes specific adjustments for regulatory and

exchange risks, which, if applied for Jirau would increase the benchmark. Another interesting reference and discussion of the value and assumptions made by ANEEL is offered by Rocha (2006). In her study she comes to the conclusion that different assumptions would lead to estimated required return on equity in the range between 13.4 and 15.4%. Again it is important to emphasize that these values are specific for the distribution business and not for investments in generation activities, but they illustrate the use of the CAPM in the context of the Brazilian reality.

In addition, considering that the distribution business earns a regulated return of 13.75% for equity investments, this represents an interesting opportunity cost for any investor as he could always invest in the distribution business instead of the more risky generation business. To assume a lower benchmark for hydropower investments would thus not be reasonable. In fact, as already cited before (World Bank, 2000) hydropower investments have a very specific risk profile, which require an increased expected rate of return to compensate for this risk. Some examples for such risks are cost overruns, construction delays, difficulties with Environmental Licensing, geological risks. With a specific reference to the risks, costs and difficulties for environmental licensing, the World Bank study has cited that a return of approximately 15% is required by an equity investor to invest in such project activities, but the same number is also cited to be the expected rate of return in the Brazilian energy sector by another more recent study about the Economics of Climate Change in Brazil (Economia do Clima, 2010).

Now when it comes to the question in relation to the investor pronouncement of GDFSUEZ on 30 May 2008, where a 12% return was cited as projected return from the investment, depending on the final Capex estimate, anticipation of the construction timeline and other variables. To understand this figure it is important to consider that this is not an investment benchmark, but the probable outcome as calculated on the basis of scenario analysis, which represents a more advanced technique of investment analysis where values and assumptions are varied around certain estimates. Given the uncertainty of many of the variables that define the Base Case as defined in the project PDD, especially considering that they were estimated according to their most ambitious value (maximum revenues and minimum cost estimates), which is conservative in terms of the CDM, the results obtained by this benchmark analysis represent the most positive outcome if all assumptions are fulfilled.

On the other hand, the 12% figure mentioned should hold if, for example plant commissioning is delayed, Capex is increased or CER prices are lower than estimated. Such a scenario analysis is not foreseen under the CDM rules, which require that investment analysis shall be developed on the basis of assumptions which are conservative in the terms of the CDM, i.e. maximize the investment return. Furthermore, the Additionality Tool explicitly requires that *"the financial/economic analysis shall be based on parameters that are standard in the market, considering the specific characteristics of the project type, but not linked to the subjective profitability expectation or risk profile of a particular project developer."*

The fact that this 12% rate which represents the average projected return would be an inappropriate benchmark for a standard investment analysis as required for the discussion of the Jirau HPP project

additionality is also evident when analysing the assumptions which were made by the Meth Panel to define a default equity benchmark, as detailed in the Information Note "Default Values for equity return of CDM projects". This document has been taken note of by the EB as a basis for the definition of the default values of the cost of equity which are offered by the IA Guidelines for PPs that do not want to define a Project Specific Benchmark. For the Brazilian Energy Sector a Default Benchmark of 11,75% was defined, which is roughly comparable to the 12% mentioned above. Now when analysing the premises that were made by the Meth Panel to define this default value, there are two fundamental reasons which require a more specific approach for the Jirau HPP project activity:

i) **On page 9 the Information Note explains:**

*Studies show that equity returns on utilities sector are historically lower than industrial sector since they are regulated and guaranteed by regulatory body.* ***Historically in utility sector there has been no competition and it is a natural monopoly.*** *Only in the developed countries, in recent years, by liberalizing power production and marketing has been made competitive.* ***However in most developing countries, utility sector is still treated as monopoly with a guaranteed return. For these reasons, utility returns are less than industry returns.***

In fact this does not apply for the liberalized Brazilian energy generation business where agents have to compete in a free market and where no minimum returns are being granted by the state or regulator. To the contrary, any cost overrun or delay has to be borne by the generator and energy sales under the regulated or liberalized market have to be honoured on the basis of firm financial guarantees. For this reason the 1% downward adjustment made by the Meth Panel is not justified in the case of energy generation projects in Brazil.

ii) **On page 14 the Information Note explains:**

*"To apply the new default equity values, [...]* ***cash flow needs to be computed based on 100% equity to ensure consistency."***

This situation does also not apply for the Jirau HPP as the project is financed up to 70% by the BNDES and, due to the high capital requirement, would not make sense from a pure equity perspective. As shown in the PDD, project financing is necessary to make the project viable and the low interest rates offered by the BNDES are necessary to raise the equity return to a level which offers acceptable returns. On the other hand this increases the equity investor's risk and therefore expected return as referenced by the financial literature already cited above.

In spite of these considerations which show that the approach taken in the Jirau HPP PDD as published for GSC, apart from some corrections that were necessary on the basis of the DOEs findings, were correct according to the rules of the CDM we would like to demonstrate that even if considering the Default Benchmark as defined by the IA Guidelines, the project requires CDM revenues to be financially feasible. The respective amendments have been made in the PDD and clearly show that,

without CERs neither the Standard Benchmark for Baseline Conditions of 12.46%, nor the Default Benchmark of 11.75% is reached. This is not only true for the Base Case and the Optimized Project under baseline conditions, but also if the full investment incentive is considered for both perspectives. In fact even if the Optimized Projects is evaluated on the basis of full consideration of all investment incentives offered by the Brazilian Development Bank, without CERs the equity IRR reaches only 10.9% and therefore does not meet the Default Benchmark and much less the project specific investment benchmark.

Finally we would like to address the suggestion that the investment analysis should be conducted on the basis of the Optimized Project, which is the configuration which is effectively being implemented.

As described in the PDD, the investment assumption at the project starting date was to develop the Jirau HPP with 46 turbines and an installed capacity of 3.450 MW, which was already above the government's original proposal of 44 turbines and 3.300 MW. This fact is referenced by the Feasibility Study Report which was submitted to the BNDES in June 2008, by the Notification on CDM consideration submitted to the Brazilian DNA and to the UNFCCC, validation offers that were received in 2009, as well as by numerous presentations and press releases originated by the BNDES and ESBR, as well as independent journalists. Now according to the CDM rules (Guidance 6) the Investment Analysis should be valid and applicable at the time of the investment decision i.e. the project starting date, which in the case of the Jirau HPP was in June 2008 when ESBR started to develop the Jirau HPP project with 46 turbines at the Ilha do Padre. As all documents available at that date demonstrate, at that time ESBR did not consider nor have information about the possibility to implement 50 turbines. Nevertheless, to demonstrate that even in the case it would have known and considered such an expansion, the project would still require CDM revenues to be financially attractive; this specific scenario has been included in the investment Analysis.

**Conclusion and responses to the comments from Fearnside and International Rivers:**

i) The project specific cost of equity (ke) under consideration of the project specific leverage as estimated on the basis of the Brazilian Development Bank's financing conditions or under standard market and default leverage conditions which apply for the baseline, has been calculated on the basis of a standard CAPM and in line with the applicable CDM rules and guidance. An accurate like for like comparison (ke in real terms) with other CDM projects and applicable literature shows that the results are fully comparable and any minor variations are explained by different time related datasets, leverage assumptions or slightly different risk profile of the activities analysed. Furthermore, we have cited references that show that the CAPM is a standard method for the estimation of the market based cost of equity and we have cited literature that shed light on the fundaments of sound financial theory and practice. We therefore hope that the doubts about any obscure and arbitrary practice for the determination of the investment benchmarks have been solved. Further we hope that the questions about the value of the World Bank publication, as comparator for Jirau's project specific equity benchmark, have been satisfied on the basis of the fact that the same value is also cited by

other references of reputed origin. Also it is well in line with other technical and regulatory publications;

ii) Following a clarification request from the DOE, the investment benchmark for additionality discussion has been revised to consider a standard financial leverage of 50% which is effectively more appropriate to judge the project's additionality under baseline conditions and which complies with Guidance 18 of the IA Guidelines. As a consequence of this revision a Standard Benchmark for Baseline Conditions of 12.46% has been adopted as general additionality criteria.

iii) In response to the question about the projected return of 12% for the Jirau project activity as cited in a interview back in March 2008 we have clarified that this is not a benchmark for investment decision, but the result of a scenario projection where different assumptions in relation to anticipation, lower CER prices and higher investment costs are taken into account. Such a scenario analysis is not foreseen and allowed under the CDM, but it is a PP internal measure to project the expected outcome of an investment in more conservative scenarios which are adequate to communicate to investors. Such "conservative scenarios" are not accepted by the CDM. We also wish to remind that the CDM does not allow using investor specific assumptions and investment criteria to discuss additionality of projects which are open to any investor;

iv) In relation to the request to compare the equity IRR as calculated for the project activity with a benchmark defined by the Brazilian Development Bank, we regret to inform that such a rate does not exist. The BNDES, as third party financier, considers the Debt Service Coverage ratio to be the relevant criteria to define and quantify the degree of financing. This DSCR has been duly taken into account to elaborate the investment analysis;

v) In any case, and to satisfy the request to compare the calculated equity IRR with a more conservative benchmark, we have now also included the comparisons and calculations with the default equity benchmark of 11,75% as defined by the IA Guidelines. To understand the value of this comparison in complement to the Standard Benchmark for Baseline Conditions Project Specific Benchmark, we have shown that this Default Benchmark is not applicable for the Jirau HPP project activity due to the fact that the Jirau HPP does not earn a regulated return of investment. In addition, when comparing it to the Project Specific Benchmark, which was calculated with a leverage of 70%, we have shown that the Default Benchmark is also not comparable because it does not take into account the increased risk which arises from financial leverage. These two features are not compatible with the premises for the definition of the Default Benchmark as it is valid for 100% equity financed projects that are developed under a regulation which offers a guaranteed return on investment. Now as the results clearly show that the project is also financially additional in comparison to this conservative benchmark;

vi) To address the suggestion of International Rivers to disclose the rate of return for the "Optimized Project" in order to allow a comparison with the benchmark and for the sake of transparency we have included this value in the PDD. Nevertheless we wish to remind that this is not a requirement of the CDM as the PP is only required to discuss the additionality of the project activity without the CDM and without the comparative advantage created by E-regulation. In addition, investment analysis shall be conducted from the perspective of the project starting date and should not take into account any later changes in project design or costs. Now to fully understand the results it is important to remind that the decision to implement the Optimized Project was taken in August 2011, under full consideration of CDM revenues. Nevertheless, for the purpose of transparency the PDD presents the hypothetic scenario that this optimisation and therefore positive evolution would have been known at the project starting date. In addition, the Optimized Project considers the highest technically possible load factor, even if not recognized by the regulator. On the other hand, negative evolutions, like cost overruns not related to the incremental installed capacity, the delays in the construction process are being ignored to address any request of conservativeness. If, as requested by IR, the project would be evaluated under the current and effective situation it would show more additional than at the project starting date.

**d) Comments and Questions in relation to project emissions**

**Summary of the comments from Fearnside:**

Fearnside generally criticizes the CDM as well as the Brazilian Government for considering hydropower plants to be as clean energy generation sources due to methane emissions from the reservoir. Though Fearnside recognized that methane emissions are reduced for small reservoirs, he criticises the CDM criteria of Power Density which allow neglecting methane as minor emission source for plants where the relation of installed capacity to the flooded area is higher than 10 W/m². Fearnside further recognized that the high water flow rate through the reservoir at Jirau will result in lower emissions than in other Amazonian dams, but that emissions would not be zero. Subsequently, Fearnside engages into a detailed discussion about the fact that the EIA considers the Jirau HPP reservoir not to be stratified due to the high turnover time and he identifies that some stratification at the reservoir's edges is expected by some authors. Fearnside further cites a personal communication which alleges to have identified stratification with anoxic bottom waters in the flooded mouth of two of the tributaries which enter the new reservoir. With such areas he expects that some methane is emitted through the surface, without the formation of bubbles, and that most of the portion of this dissolved methane would then be prevented from reaching the turbines due to oxygenated water in the main channel.

Furthermore Fearnside criticizes the CDM rule for Power Density to contemplate only additionally flooded area, while the natural river bed is excluded from the calculation. In his view this is wrong as the surface of the natural river bed will also generate methane emissions.

**Background information to our responses:**

The discussion around Greenhouse Gas (GHG) Emissions from freshwater reservoirs continues to be an important issue and as cited above, the Brazilian government has taken important and explicit steps to minimize the risk that such emissions arise from the implementation of new reservoirs by focusing on the development and offering of concessions for run-of-river reservoirs with high power density (Bezerra et al, 2010). EPE, 2007 is clear by considering this as a trade-off which leads to loss of generation capacity, while on the other hand this opens the opportunity to obtain CDM financing for such projects. We therefore have to recognize that once again, the Brazilian government made energetic and economic concessions in benefit of the global good of GHG mitigation.

Now when analysing the status of this discussions, it is of interest to consider that Fearnside's submission, as well as his articles and other references used (Abril et al., 2005; Fearnside, 2002, 2005a,b; Kemenes et al., 2007, 2011), base the argument that reservoirs in the Amazon are a significant source of high gross GHG emissions on few very specific examples of hydropower reservoirs with large shallow reservoirs and low energy production and therefore low Power Density factors, such as Petit Saunt (Power Density = 0.4 $W/m^2$) Balbina (Power Density = 0.09 $W/m^2$); and Tucurui (Power Density = 1.63 $W/m^2$). These chosen plants and therefore the studies derived from them are not comparable to modern run-of-river hydropower investments such as the Jirau HPP project activity. In addition to this bias of choosing non representative examples, the discussion is being hampered by the fact that these studies generally measure gross GHG emissions, which means that they neglect the fact that any sweet water course, natural or manmade, may act as a source of GHG emissions, which means that not all GHG emissions measured at a manmade reservoir can be attributed to the project as part of these emissions would have been generated also in the absence of the project. Now even recognizing the overestimation that the contemplation of considering gross GHG estimation implies, Santos et al (2006) have made a comparative study which shows that the Power Density factor is a meaningful proxy to identify hydropower plants with negligible gross GHG emissions when compared to fossil fuel energy generation options.

Since then the progress of the discussion, as well as the fundamental principle that only net GHG emissions shall be taken into account was recorded by IPCC (2011), which defines net GHG emissions from freshwater reservoirs as those *"excluding unrelated anthropogenic sources and pre-existing natural emissions"*, and asserts that: *"the assessment of man-made net emissions involves: a) appropriate estimation of the natural emissions from the terrestrial ecosystem, wetlands, rivers and lakes that were located in the area before impoundment; and b) abstracting the effect of carbon inflow from the terrestrial ecosystem, both natural and related to human activities, on the net GHG emissions before and after impoundment."*

Therefore, to make constructive progress in this discussion, a more representative analysis of the scientific literature has to be taken into account. Such an analysis shows that it is not correct to classify hydropower projects as a general source of significant net GHG emissions and that there is increasing evidence that life-cycle emissions of hydropower, are in fact very low.

Such solid results are derived from recently developed knowledge which shows that reservoirs emissions are significantly smaller than previously estimated (Barros et al., 2011; Chanudet et al., 2011), while the terrestrial GHG sink may be smaller than currently believed (Bastviken et al., 2011). Also, new studies show that tropical and sub-tropical reservoirs can behave as carbon sinks (Sikar et al., 2009; Chanudet et al., 2011; Ometto et al., 201?).

A representative literature review for Life Cycle Emissions (LCA - Life Cycle Assessments) of hydropower and other energy sources has been conducted by the IPCC (2011) to assess GHG emissions from reservoir and run-of-river hydropower plants. The study is clear by expressing that *"The LCAs evaluated in this assessment only accounted for gross LUC(Land Use Change)-related emissions. Characterizing a reservoir as a net emitter of GHG implies consideration of emissions that would have occurred without the reservoir, which is an area of active research"*. Now, in spite of this limitation, the IPCC as identified hydropower and especially run-of-river plants to have the lowest GHG emissions of all commercially available electricity generation sources, including wind and solar. Graph 9.8 of the publication is replicated below in Figure 4. The comparison is also interesting because it shows the increased advantage of hydropower from the perspective of Life Cycle Assessments where the emission intensities of Gas, Coal and Fuel oil generated electricity are significantly higher than the emission factors which are used to calculate the emission reductions which are calculated and certified on the basis of UNFCCC methodologies. Though this is an obvious fact due to the large direct (coal mine gas, flaring and venting of natural gas and associated gas) and indirect emissions (production, transport, refinery) related to the production of fossil fuels, this issue (and therefore this benefit of renewable energies) gains only reduced attention while the discussions around GHG emissions from hydropower plants is emphasized without taking the recent scientific progress adequately into account.

interesting to recognize that the incentives and the comparative advantage for hydro and other renewable are in fact being opposed by industry associations which promotes the use of coal for energy generation. In a Press release from 14 December 2010, the Brazilian Association for Mineral Coal (ABCM, 2010) states: *"Few know, but in 2008, the Brazilian Development Bank progressed in its policy to promote a "clean" expansion of the energy supply: it reduced the basic "spread" applicable to large scale hydropower plants to 0,5% and for other energies with low GHG intensity to 0,9% and increased to 1.8% the rate applied for thermal coal and fuel oil fired thermal plants".* In the remainder of the article the association argues that the high capital intensity of renewable energy projects and the high cost of such incentives would not be appropriate in the context of a developing country like Brazil where 30 million people need to be lifted out of misery and that all forms of energy, including national coal need to be contemplated for the countries development. Though the ABMC obviously questions the high cost that these policies have for the Brazilian society, the article allows us to conclude that the Brazilian Development's policy for promotion of renewable energies has been effective to reduce the expansion of fossil fuel fired alternatives and was established against the interest of industries that seek to promote coal fired generation alternatives.

In relation to the question why the spread for hydropower is lower than for other renewable energies, the response is related to the fact that hydropower plants are more sensitive to interest rates due to their long construction time. While wind projects can be operational in 18 months, large hydropower plants take up to 5 years or more to be completed. This leads to high cost for interests during construction, which is one of the main barriers for hydropower developments as cited before. In consideration of this fact, the World Bank (2000) recommends *"the availability of longer-term finance at low cost".* In line with this recommendation the BNDES provided a statement to clarify the background of its policy:

*"On the basis of a differentiation in basic spread, the extension of the financing duration, next to the increased participation in financing, it was possible to reduce the financial cost of hydropower investments to a level which granted them with competitiveness in relation to the financial cost of coal and fuel oil based generation plants"(BNDES, 2012, translation ours).*

Finally we would like to clarify CER revenues have been contemplated as revenues for obtaining the loan from the BNDES, which illustrates the importance of the CDM to contribute to overcoming the barriers related to its high capital intensity and the consecutive lack of access to appropriate financing.

**Conclusion and responses to the comments from Fearnside and International Rivers:**

- In fact Annex 3, EB 22 defines an E- policy only on the basis of the fact that a comparative advantage has been identified *to less emissions-intensive technologies over more emissions-intensive technologies (e.g. public subsidies to promote the diffusion of renewable energy)* and therefore it is not of relevance if the policy was established with the explicitly objective to mitigate GHG emissions. In any case, it has been shown on the basis of numerous governmental documents and references that the implementation of the Jirau HPP and other

renewable energies investments since 2008 are effectively related to Brazils National Climate Change Mitigation Policy. Further it was shows that the support policies defined by the government were important for the project's licensing and financial viability and that that CDM revenues have been consistently considered not only by the investor, but also by the government when planning, licensing and financing the project activity;

- The PDD was developed on the basis of Annex 03 of EB 22 and contains a detailed analysis of all *"relevant national and/or sectoral policies and circumstances, such as sectoral reform initiatives, local fuel availability, power sector expansion plans, and the economic situation in the project sector"* has been offered. Incentives which represent a comparative advantage to the implementation of the Project Activity have been identified and a hypothetical baseline without these policies has been established. Other incentives, which do not represent a comparative advantage when compared to GHG intensive technologies, have been fully considered in the baseline and investment analysis;

- In relation to Fearnside accusation that the *"The PDD fails to mention the massive subsidy in public funding that Jirau receives from a non- Annex I party, namely Brazil"* we believe that there is a misinterpretation of the CDM rules. In fact Fearnside correctly identified the investment incentives offered by the BNDES on the basis of the PDD that was presented for GSC, but he seems to understand that it would be necessary to include this in section A.5. and Appendix 2 of the PDD. Now according to Annex 8, EB 66 (2012), the requirement is to *"Indicate whether the project activity receives public funding from Parties included in Annex I"*. As Brazil is not an Annex I party the PPs understand that it would be wrong to make reference to the fact that Brazil is financing the project activity. In any case this fact has been adequately highlighted in other sections of the PDD.

In conclusion we hope that our comments were able to address the doubts and questions raised by the submission received.

**c) Comments on investment benchmark and accuracy of the investment analysis**

**Summary of the comments from Fearnside and International Rivers:**

Both Fearnside and the IHA criticise the benchmark used to for the demonstration of additionality. Fearnside says that the investor is free to choose any suitable higher benchmark and that *"the values appear to be essentially picked out of a hat"* and constructed on arbitrarily chosen variables and correction factors. IR declares that the CAPM used by the PP is obscure and *"does not accurately represent the actual hurdle rate of investors"*. In addition, both IR and Fearnside compare the benchmark used in the Jirau PDD with those used by other Project activities and argue that the benchmark used in the Jirau PDD is significantly higher. Furthermore, Fearnside also criticises the reference of the World Bank, which was used as comparator by the PP, not to be a credible reference. In complementation to this criticism, IR also cites investor announcements made by GDFSUEZ at the

time of the project starting date which declare that the projected return for the project is estimated to be about 12%, depending on the final Capex estimate and installation chronogram. As a consequence IR requests that the hurdle rate of the BNDES should be applied, rather than an equity investor specific benchmark.

Complementary to the doubts about the benchmark, IR also questions that the investment comparison including the E- policy is only being conducted with the "Base Case", which is the plant configuration that was considered at the project starting date, and not with the "Optimized Project" which is effectively being implemented. The argument made by IR is that the IRR return of the Optimized Project and under full consideration of the Brazilian Development Bank incentives would be higher than the benchmarks used by other comparable CDM projects and thus the project would show to be non additional.

**Background information to our responses:**

First we would wish to clarify that the benchmark used in the Jirau HPP PDD as calculated with the Capital Asset Pricing Model (CAPM) represents the cost of equity (Ke) in real terms as calculated for the project starting date. Investment Analysis and benchmark have been defined in line with the "Tool for the demonstration and assessment of additionality", here referred to as the *Additionality Tool* (Annex 21, EB65, 2011) and the "Guidelines on the assessment of investment analysis" here referred to as the *IA Guidelines* (Annex 5, EB62, 2011).

Therefore the benchmark calculated for the Jirau HPP is not comparable with the Weighted Average Cost of Capital (WACC) used by the Teles Pires Hydropower Plant Project Activity or the Santo Antonio Hydropower Project. The WACC used in the PDDs of the cited projects is an adequate benchmark to judge the return from the perspective of a project as a whole, while the Cost of Equity (Ke) is adequate to judge the return as calculated for the shareholder capital, i.e. the return on the share of project financed by equity and after full consideration of the debt financing, amortisation and interest payments. According to Guidance 12 of the IA Guidelines, both strategies are accepted, but it is important to compare like for like to avoid wrong conclusions.

Now as the WACC is calculated on the basis of the Cost of Equity (Ke) and the Cost of Debt it is possible to compare the Ke value calculated for the Jirau HPP with that used by the other project activities. As referenced by page 14 of the PDD for Santo Antonio, a Ke of 17.31% in real terms has been calculated. As the project starting date of the Santo Antonio project activity is about a year before the Jirau project activity, values are not directly comparable, but the benchmark was calculated to be in the same range of Jirau's Project Specific Benchmark..

In the case of the Teles Pires project activity, page 15 of the PDD indicates that the cost of equity was calculated to be 12.46% in real terms. Again this is not directly comparable as the project starting date of the Teles Pires project is in August 2011, more than three years after the project starting date of the Jirau CDM project activity.

In addition it is important to recognize that the Teles Pires projects considers a default financing rate of 50%, while the Project Specific Benchmark as calculated for the Jirau HPP considers a leverage of 70% as estimated at the time of the project starting date based on the indicative conditions published by the BNDES in April 2008. This project specific variable is also in line with the Feasibility Study Report which was submitted to the BNDES as basis for the project financing and compatible with the final figure finally agreed with in the loan agreement (68,5%).

Now as the increased leverage is effectively part of Brazilian Development Bank's investment incentives, it is part of the E- policy as discussed above. As a consequence the DOE requested to revise the benchmark to also reflect the baseline conditions which were defined for the additionality assessment, i.e. to adopt a standard leverage of 50% as offered for GHG intensive generation sources and which ignore the comparative advantage offered by the BNDES. Moreover, the use of a 50% default leverage is also in line with the Guidance 18 of the IA guidelines. PPs agree to this interpretation of the CDM rules and the Standard Benchmark for Baseline Conditions of 12,46% has been calculated and defined as appropriate additionality criteria of the equity IRR as calculated under baseline conditions, i.e. with a leverage of 50%. This value is now, as a matter of coincidence, exactly identical to the figure adopted by the Telles Pires Project. The PDD has been amended accordingly and the Project Specific Benchmark of 16,05% is only being used to illustrate how the investment incentives and the CDM contribute to make the project activity viable under the specific financial leverage conditions offered by the Brazilian Development Bank.

As a consequence of this simple correction and the applicable comparison we hope to have solved the doubt about any perceived conflict of the approach taken in the Jirau HPP PDD and other project activities. In fact the investment analysis for the Jirau HPP follows Guidance 10 of the Investment Analysis Guidelines, which means that the return on the Jirau HPP equity investment has been calculated after full consideration of the debt financing, amortisation and interest payments. Also, the calculation of the benchmark is based on parameters that are standard in the market and does not consider subjective profit expectations of any particular investor, as required by Guidance 13. This is further regulated by Guidance 15, which allows defining the cost of equity on the basis of simple default values offered by the IA Guidelines (and which will be discussed below), *"or by calculating the cost of equity using best financial practices, based on data sources which can be clearly validated by the DOE, while properly justifying all underlying factors"*. Moreover now Gudiance 18 is being observed and a default leverage of 50% has been applied, which is in line with the standard financing conditions which the BNFDES offers to GHG intensive generation technologies. Based on these options and guidance and after due validation by the DOE a Standard Benchmark for Baseline Conditions of 12.46% has been defined as additionality criteria under baseline conditions, while a slightly corrected Project Specific Benchmark of 16,05% is only used to illustrate the importance of the BNDES incentives and the CDM to reach the project specific cost of equity.

To better understand the concepts behind the CDM rules which guide investment analysis and the definition of an investment benchmark, it is important to consider the fundaments of the financial theory and for reference we indicate Brealey and Myers (2003), Copeland, Koller and Murrin (2002)

and Damodaran (2002). The fundamental premise of financial theory and practice is the positive relation between the risk profile of an investment activity and the expected return. In the case of the Capital Asset Pricing Model, which is the most commonly used tool for the definition of the cost of equity, the return is directly proportional to the non diversifiable market risk of a specific investment activity. This proportionality is given by the Security Market Line. This follows the simple idea that any investor can simply buy and sell capital market instruments according to his risk profile and then gain the financial return which corresponds to the chosen allocation. Based on this premise, the minimum return for an investment activity is therefore defined as the opportunity cost of the funds, i.e. the yield which could be obtained by investing the money on the capital markets at a risk which is equivalent to the risk of the project activity. In other words, if a project yields a return which is equivalent to this opportunity cost, the investor should be indifferent to invest or not to invest in the project. Now as all market parameters fluctuate and evolve constantly, this opportunity costs is time depending and therefore has to be calculated at any specific point in time. This theory has been adopted by the CDM, which requires that the benchmark is to be defined by parameters that are standard in the market at the time of the project starting date.

According to Rocha (2006), who offers and excellent and very didactic introduction to the issue from the Brazilian perspective, the CAPM is the standard methodology to estimate the cost of equity, also for the purpose of regulation and it is used in countries like the UK, Australia, the US, Spain, Argentina and Chile. Now in the case of Brazil, the power generation sector is not regulated, but based on free competition and therefore a governmentally defined hurdle rate does not exist. In contrast, the electricity distribution business is regulated and the government does calculate and define the appropriate hurdle rate and the result can serve as a comparator. The economic rationale used by the regulator ANEEL, together with the applicable financial theory, is explained in detail by a technical note issued in March 2007 (ANEEL, 2007). This technical note and the values are result of a broad public consultation process and the value was defined to calculate distribution tariffs for the years 2007-2009 and therefore was valid at the time of the Jirau HPP project starting date. Nevertheless, as the variables and calculations represent the situation about 15 month before the project starting date the numbers are not completely compatible. In addition, ANEEL calculated the expected return on equity for the distribution business, which has a different risk profile than the generation business. For these reasons, both values are not directly comparable, but they obviously allow comparing and validating the approach taken in the Jirau HPP PDD.

As can be seen from the reference, the expected return on equity invested in the distribution sector is 13.75% and thus broadly comparable to the Standard Benchmark for Baseline Conditions (12,46%), or the Project Specific Benchmark (16,05%) as calculated for the Jirau HPP project activity. Differences are mainly explained by the different assumptions for financial leverage, which is assumed to be 50% in the case of Jirau's Standard Benchmark for Baseline Conditions and 70% in the vase of the Project Specific Benchmark, , versus a 57% average in the distribution sector. Another difference is that the beta for the distribution sector, which has regulated returns, is slightly lower that the beta of generation activities. In addition to that, ANEEL makes specific adjustments for regulatory and

exchange risks, which, if applied for Jirau would increase the benchmark. Another interesting reference and discussion of the value and assumptions made by ANEEL is offered by Rocha (2006). In her study she comes to the conclusion that different assumptions would lead to estimated required return on equity in the range between 13.4 and 15.4%. Again it is important to emphasize that these values are specific for the distribution business and not for investments in generation activities, but they illustrate the use of the CAPM in the context of the Brazilian reality.

In addition, considering that the distribution business earns a regulated return of 13.75% for equity investments, this represents an interesting opportunity cost for any investor as he could always invest in the distribution business instead of the more risky generation business. To assume a lower benchmark for hydropower investments would thus not be reasonable. In fact, as already cited before (World Bank, 2000) hydropower investments have a very specific risk profile, which require an increased expected rate of return to compensate for this risk. Some examples for such risks are cost overruns, construction delays, difficulties with Environmental Licensing, geological risks. With a specific reference to the risks, costs and difficulties for environmental licensing, the World Bank study has cited that a return of approximately 15% is required by an equity investor to invest in such project activities, but the same number is also cited to be the expected rate of return in the Brazilian energy sector by another more recent study about the Economics of Climate Change in Brazil (Economia do Clima, 2010).

Now when it comes to the question in relation to the investor pronouncement of GDFSUEZ on 30 May 2008, where a 12% return was cited as projected return from the investment, depending on the final Capex estimate, anticipation of the construction timeline and other variables. To understand this figure it is important to consider that this is not an investment benchmark, but the probable outcome as calculated on the basis of scenario analysis, which represents a more advanced technique of investment analysis where values and assumptions are varied around certain estimates. Given the uncertainty of many of the variables that define the Base Case as defined in the project PDD, especially considering that they were estimated according to their most ambitious value (maximum revenues and minimum cost estimates), which is conservative in terms of the CDM, the results obtained by this benchmark analysis represent the most positive outcome if all assumptions are fulfilled.

On the other hand, the 12% figure mentioned should hold if, for example plant commissioning is delayed, Capex is increased or CER prices are lower than estimated. Such a scenario analysis is not foreseen under the CDM rules, which require that investment analysis shall be developed on the basis of assumptions which are conservative in the terms of the CDM, i.e. maximize the investment return. Furthermore, the Additionality Tool explicitly requires that *"the financial/economic analysis shall be based on parameters that are standard in the market, considering the specific characteristics of the project type, but not linked to the subjective profitability expectation or risk profile of a particular project developer."*

The fact that this 12% rate which represents the average projected return would be an inappropriate benchmark for a standard investment analysis as required for the discussion of the Jirau HPP project

additionality is also evident when analysing the assumptions which were made by the Meth Panel to define a default equity benchmark, as detailed in the Information Note "Default Values for equity return of CDM projects". This document has been taken note of by the EB as a basis for the definition of the default values of the cost of equity which are offered by the IA Guidelines for PPs that do not want to define a Project Specific Benchmark. For the Brazilian Energy Sector a Default Benchmark of 11,75% was defined, which is roughly comparable to the 12% mentioned above. Now when analysing the premises that were made by the Meth Panel to define this default value, there are two fundamental reasons which require a more specific approach for the Jirau HPP project activity:

i) **On page 9 the Information Note explains:**

*Studies show that equity returns on utilities sector are historically lower than industrial sector since they are regulated and guaranteed by regulatory body.* ***Historically in utility sector there has been no competition and it is a natural monopoly.*** *Only in the developed countries, in recent years, by liberalizing power production and marketing has been made competitive.* ***However in most developing countries, utility sector is still treated as monopoly with a guaranteed return. For these reasons, utility returns are less than industry returns.***

In fact this does not apply for the liberalized Brazilian energy generation business where agents have to compete in a free market and where no minimum returns are being granted by the state or regulator. To the contrary, any cost overrun or delay has to be borne by the generator and energy sales under the regulated or liberalized market have to be honoured on the basis of firm financial guarantees. For this reason the 1% downward adjustment made by the Meth Panel is not justified in the case of energy generation projects in Brazil.

ii) **On page 14 the Information Note explains:**

*"To apply the new default equity values, [...]* ***cash flow needs to be computed based on 100% equity to ensure consistency."***

This situation does also not apply for the Jirau HPP as the project is financed up to 70% by the BNDES and, due to the high capital requirement, would not make sense from a pure equity perspective. As shown in the PDD, project financing is necessary to make the project viable and the low interest rates offered by the BNDES are necessary to raise the equity return to a level which offers acceptable returns. On the other hand this increases the equity investor's risk and therefore expected return as referenced by the financial literature already cited above.

In spite of these considerations which show that the approach taken in the Jirau HPP PDD as published for GSC, apart from some corrections that were necessary on the basis of the DOEs findings, were correct according to the rules of the CDM we would like to demonstrate that even if considering the Default Benchmark as defined by the IA Guidelines, the project requires CDM revenues to be financially feasible. The respective amendments have been made in the PDD and clearly show that,

without CERs neither the Standard Benchmark for Baseline Conditions of 12.46%, nor the Default Benchmark of 11.75% is reached. This is not only true for the Base Case and the Optimized Project under baseline conditions, but also if the full investment incentive is considered for both perspectives. In fact even if the Optimized Projects is evaluated on the basis of full consideration of all investment incentives offered by the Brazilian Development Bank, without CERs the equity IRR reaches only 10.9% and therefore does not meet the Default Benchmark and much less the project specific investment benchmark.

Finally we would like to address the suggestion that the investment analysis should be conducted on the basis of the Optimized Project, which is the configuration which is effectively being implemented.

As described in the PDD, the investment assumption at the project starting date was to develop the Jirau HPP with 46 turbines and an installed capacity of 3.450 MW, which was already above the government's original proposal of 44 turbines and 3.300 MW. This fact is referenced by the Feasibility Study Report which was submitted to the BNDES in June 2008, by the Notification on CDM consideration submitted to the Brazilian DNA and to the UNFCCC, validation offers that were received in 2009, as well as by numerous presentations and press releases originated by the BNDES and ESBR, as well as independent journalists. Now according to the CDM rules (Guidance 6) the Investment Analysis should be valid and applicable at the time of the investment decision i.e. the project starting date, which in the case of the Jirau HPP was in June 2008 when ESBR started to develop the Jirau HPP project with 46 turbines at the Ilha do Padre. As all documents available at that date demonstrate, at that time ESBR did not consider nor have information about the possibility to implement 50 turbines. Nevertheless, to demonstrate that even in the case it would have known and considered such an expansion, the project would still require CDM revenues to be financially attractive; this specific scenario has been included in the investment Analysis.

**Conclusion and responses to the comments from Fearnside and International Rivers:**

i) The project specific cost of equity (ke) under consideration of the project specific leverage as estimated on the basis of the Brazilian Development Bank's financing conditions or under standard market and default leverage conditions which apply for the baseline, has been calculated on the basis of a standard CAPM and in line with the applicable CDM rules and guidance. An accurate like for like comparison (ke in real terms) with other CDM projects and applicable literature shows that the results are fully comparable and any minor variations are explained by different time related datasets, leverage assumptions or slightly different risk profile of the activities analysed. Furthermore, we have cited references that show that the CAPM is a standard method for the estimation of the market based cost of equity and we have cited literature that shed light on the fundaments of sound financial theory and practice. We therefore hope that the doubts about any obscure and arbitrary practice for the determination of the investment benchmarks have been solved. Further we hope that the questions about the value of the World Bank publication, as comparator for Jirau's project specific equity benchmark, have been satisfied on the basis of the fact that the same value is also cited by

other references of reputed origin. Also it is well in line with other technical and regulatory publications;

ii) Following a clarification request from the DOE, the investment benchmark for additionality discussion has been revised to consider a standard financial leverage of 50% which is effectively more appropriate to judge the project's additionality under baseline conditions and which complies with Guidance 18 of the IA Guidelines. As a consequence of this revision a Standard Benchmark for Baseline Conditions of 12.46% has been adopted as general additionality criteria.

iii) In response to the question about the projected return of 12% for the Jirau project activity as cited in a interview back in March 2008 we have clarified that this is not a benchmark for investment decision, but the result of a scenario projection where different assumptions in relation to anticipation, lower CER prices and higher investment costs are taken into account. Such a scenario analysis is not foreseen and allowed under the CDM, but it is a PP internal measure to project the expected outcome of an investment in more conservative scenarios which are adequate to communicate to investors. Such "conservative scenarios" are not accepted by the CDM. We also wish to remind that the CDM does not allow using investor specific assumptions and investment criteria to discuss additionality of projects which are open to any investor;

iv) In relation to the request to compare the equity IRR as calculated for the project activity with a benchmark defined by the Brazilian Development Bank, we regret to inform that such a rate does not exist. The BNDES, as third party financier, considers the Debt Service Coverage ratio to be the relevant criteria to define and quantify the degree of financing. This DSCR has been duly taken into account to elaborate the investment analysis;

v) In any case, and to satisfy the request to compare the calculated equity IRR with a more conservative benchmark, we have now also included the comparisons and calculations with the default equity benchmark of 11,75% as defined by the IA Guidelines. To understand the value of this comparison in complement to the Standard Benchmark for Baseline Conditions Project Specific Benchmark, we have shown that this Default Benchmark is not applicable for the Jirau HPP project activity due to the fact that the Jirau HPP does not earn a regulated return of investment. In addition, when comparing it to the Project Specific Benchmark, which was calculated with a leverage of 70%, we have shown that the Default Benchmark is also not comparable because it does not take into account the increased risk which arises from financial leverage. These two features are not compatible with the premises for the definition of the Default Benchmark as it is valid for 100% equity financed projects that are developed under a regulation which offers a guaranteed return on investment. Now as the results clearly show that the project is also financially additional in comparison to this conservative benchmark;

vi) To address the suggestion of International Rivers to disclose the rate of return for the "Optimized Project" in order to allow a comparison with the benchmark and for the sake of transparency we have included this value in the PDD. Nevertheless we wish to remind that this is not a requirement of the CDM as the PP is only required to discuss the additionality of the project activity without the CDM and without the comparative advantage created by E-regulation. In addition, investment analysis shall be conducted from the perspective of the project starting date and should not take into account any later changes in project design or costs. Now to fully understand the results it is important to remind that the decision to implement the Optimized Project was taken in August 2011, under full consideration of CDM revenues. Nevertheless, for the purpose of transparency the PDD presents the hypothetic scenario that this optimisation and therefore positive evolution would have been known at the project starting date. In addition, the Optimized Project considers the highest technically possible load factor, even if not recognized by the regulator. On the other hand, negative evolutions, like cost overruns not related to the incremental installed capacity, the delays in the construction process are being ignored to address any request of conservativeness. If, as requested by IR, the project would be evaluated under the current and effective situation it would show more additional than at the project starting date.

**d) Comments and Questions in relation to project emissions**

**Summary of the comments from Fearnside:**

Fearnside generally criticizes the CDM as well as the Brazilian Government for considering hydropower plants to be as clean energy generation sources due to methane emissions from the reservoir. Though Fearnside recognized that methane emissions are reduced for small reservoirs, he criticises the CDM criteria of Power Density which allow neglecting methane as minor emission source for plants where the relation of installed capacity to the flooded area is higher than 10 $W/m^2$. Fearnside further recognized that the high water flow rate through the reservoir at Jirau will result in lower emissions than in other Amazonian dams, but that emissions would not be zero. Subsequently, Fearnside engages into a detailed discussion about the fact that the EIA considers the Jirau HPP reservoir not to be stratified due to the high turnover time and he identifies that some stratification at the reservoir's edges is expected by some authors. Fearnside further cites a personal communication which alleges to have identified stratification with anoxic bottom waters in the flooded mouth of two of the tributaries which enter the new reservoir. With such areas he expects that some methane is emitted through the surface, without the formation of bubbles, and that most of the portion of this dissolved methane would then be prevented from reaching the turbines due to oxygenated water in the main channel.

Furthermore Fearnside criticizes the CDM rule for Power Density to contemplate only additionally flooded area, while the natural river bed is excluded from the calculation. In his view this is wrong as the surface of the natural river bed will also generate methane emissions.

**Background information to our responses:**

The discussion around Greenhouse Gas (GHG) Emissions from freshwater reservoirs continues to be an important issue and as cited above, the Brazilian government has taken important and explicit steps to minimize the risk that such emissions arise from the implementation of new reservoirs by focusing on the development and offering of concessions for run-of-river reservoirs with high power density (Bezerra et al, 2010). EPE, 2007 is clear by considering this as a trade-off which leads to loss of generation capacity, while on the other hand this opens the opportunity to obtain CDM financing for such projects. We therefore have to recognize that once again, the Brazilian government made energetic and economic concessions in benefit of the global good of GHG mitigation.

Now when analysing the status of this discussions, it is of interest to consider that Fearnside's submission, as well as his articles and other references used (Abril et al., 2005; Fearnside, 2002, 2005a,b; Kemenes et al., 2007, 2011), base the argument that reservoirs in the Amazon are a significant source of high gross GHG emissions on few very specific examples of hydropower reservoirs with large shallow reservoirs and low energy production and therefore low Power Density factors, such as Petit Saunt (Power Density = 0.4 $W/m^2$) Balbina (Power Density = 0.09 $W/m^2$); and Tucurui (Power Density = 1.63 $W/m^2$). These chosen plants and therefore the studies derived from them are not comparable to modern run-of-river hydropower investments such as the Jirau HPP project activity. In addition to this bias of choosing non representative examples, the discussion is being hampered by the fact that these studies generally measure gross GHG emissions, which means that they neglect the fact that any sweet water course, natural or manmade, may act as a source of GHG emissions, which means that not all GHG emissions measured at a manmade reservoir can be attributed to the project as part of these emissions would have been generated also in the absence of the project. Now even recognizing the overestimation that the contemplation of considering gross GHG estimation implies, Santos et al (2006) have made a comparative study which shows that the Power Density factor is a meaningful proxy to identify hydropower plants with negligible gross GHG emissions when compared to fossil fuel energy generation options.

Since then the progress of the discussion, as well as the fundamental principle that only net GHG emissions shall be taken into account was recorded by IPCC (2011), which defines net GHG emissions from freshwater reservoirs as those *"excluding unrelated anthropogenic sources and pre-existing natural emissions"*, and asserts that: *"the assessment of man-made net emissions involves: a) appropriate estimation of the natural emissions from the terrestrial ecosystem, wetlands, rivers and lakes that were located in the area before impoundment; and b) abstracting the effect of carbon inflow from the terrestrial ecosystem, both natural and related to human activities, on the net GHG emissions before and after impoundment."*

Therefore, to make constructive progress in this discussion, a more representative analysis of the scientific literature has to be taken into account. Such an analysis shows that it is not correct to classify hydropower projects as a general source of significant net GHG emissions and that there is increasing evidence that life-cycle emissions of hydropower, are in fact very low.

Such solid results are derived from recently developed knowledge which shows that reservoirs emissions are significantly smaller than previously estimated (Barros et al., 2011; Chanudet et al., 2011), while the terrestrial GHG sink may be smaller than currently believed (Bastviken et al., 2011). Also, new studies show that tropical and sub-tropical reservoirs can behave as carbon sinks (Sikar et al., 2009; Chanudet et al., 2011; Ometto et al., 201?).

A representative literature review for Life Cycle Emissions (LCA - Life Cycle Assessments) of hydropower and other energy sources has been conducted by the IPCC (2011) to assess GHG emissions from reservoir and run-of-river hydropower plants. The study is clear by expressing that *"The LCAs evaluated in this assessment only accounted for gross LUC(Land Use Change)-related emissions. Characterizing a reservoir as a net emitter of GHG implies consideration of emissions that would have occurred without the reservoir, which is an area of active research"*. Now, in spite of this limitation, the IPCC as identified hydropower and especially run-of-river plants to have the lowest GHG emissions of all commercially available electricity generation sources, including wind and solar. Graph 9.8 of the publication is replicated below in Figure 4. The comparison is also interesting because it shows the increased advantage of hydropower from the perspective of Life Cycle Assessments where the emission intensities of Gas, Coal and Fuel oil generated electricity are significantly higher than the emission factors which are used to calculate the emission reductions which are calculated and certified on the basis of UNFCCC methodologies. Though this is an obvious fact due to the large direct (coal mine gas, flaring and venting of natural gas and associated gas) and indirect emissions (production, transport, refinery) related to the production of fossil fuels, this issue (and therefore this benefit of renewable energies) gains only reduced attention while the discussions around GHG emissions from hydropower plants is emphasized without taking the recent scientific progress adequately into account.

interesting to recognize that the incentives and the comparative advantage for hydro and other renewable are in fact being opposed by industry associations which promotes the use of coal for energy generation. In a Press release from 14 December 2010, the Brazilian Association for Mineral Coal (ABCM, 2010) states: *"Few know, but in 2008, the Brazilian Development Bank progressed in its policy to promote a "clean" expansion of the energy supply: it reduced the basic "spread" applicable to large scale hydropower plants to 0,5% and for other energies with low GHG intensity to 0,9% and increased to 1.8% the rate applied for thermal coal and fuel oil fired thermal plants".* In the remainder of the article the association argues that the high capital intensity of renewable energy projects and the high cost of such incentives would not be appropriate in the context of a developing country like Brazil where 30 million people need to be lifted out of misery and that all forms of energy, including national coal need to be contemplated for the countries development. Though the ABMC obviously questions the high cost that these policies have for the Brazilian society, the article allows us to conclude that the Brazilian Development's policy for promotion of renewable energies has been effective to reduce the expansion of fossil fuel fired alternatives and was established against the interest of industries that seek to promote coal fired generation alternatives.

In relation to the question why the spread for hydropower is lower than for other renewable energies, the response is related to the fact that hydropower plants are more sensitive to interest rates due to their long construction time. While wind projects can be operational in 18 months, large hydropower plants take up to 5 years or more to be completed. This leads to high cost for interests during construction, which is one of the main barriers for hydropower developments as cited before. In consideration of this fact, the World Bank (2000) recommends *"the availability of longer-term finance at low cost".* In line with this recommendation the BNDES provided a statement to clarify the background of its policy:

*"On the basis of a differentiation in basic spread, the extension of the financing duration, next to the increased participation in financing, it was possible to reduce the financial cost of hydropower investments to a level which granted them with competitiveness in relation to the financial cost of coal and fuel oil based generation plants"(BNDES, 2012, translation ours).*

Finally we would like to clarify CER revenues have been contemplated as revenues for obtaining the loan from the BNDES, which illustrates the importance of the CDM to contribute to overcoming the barriers related to its high capital intensity and the consecutive lack of access to appropriate financing.

**Conclusion and responses to the comments from Fearnside and International Rivers:**

- In fact Annex 3, EB 22 defines an E- policy only on the basis of the fact that a comparative advantage has been identified *to less emissions-intensive technologies over more emissions-intensive technologies (e.g. public subsidies to promote the diffusion of renewable energy)* and therefore it is not of relevance if the policy was established with the explicitly objective to mitigate GHG emissions. In any case, it has been shown on the basis of numerous governmental documents and references that the implementation of the Jirau HPP and other

renewable energies investments since 2008 are effectively related to Brazils National Climate Change Mitigation Policy. Further it was shows that the support policies defined by the government were important for the project's licensing and financial viability and that that CDM revenues have been consistently considered not only by the investor, but also by the government when planning, licensing and financing the project activity;

- The PDD was developed on the basis of Annex 03 of EB 22 and contains a detailed analysis of all *"relevant national and/or sectoral policies and circumstances, such as sectoral reform initiatives, local fuel availability, power sector expansion plans, and the economic situation in the project sector"* has been offered. Incentives which represent a comparative advantage to the implementation of the Project Activity have been identified and a hypothetical baseline without these policies has been established. Other incentives, which do not represent a comparative advantage when compared to GHG intensive technologies, have been fully considered in the baseline and investment analysis;

- In relation to Fearnside accusation that the *"The PDD fails to mention the massive subsidy in public funding that Jirau receives from a non- Annex I party, namely Brazil"* we believe that there is a misinterpretation of the CDM rules. In fact Fearnside correctly identified the investment incentives offered by the BNDES on the basis of the PDD that was presented for GSC, but he seems to understand that it would be necessary to include this in section A.5. and Appendix 2 of the PDD. Now according to Annex 8, EB 66 (2012), the requirement is to *"Indicate whether the project activity receives public funding from Parties included in Annex I"*. As Brazil is not an Annex I party the PPs understand that it would be wrong to make reference to the fact that Brazil is financing the project activity. In any case this fact has been adequately highlighted in other sections of the PDD.

In conclusion we hope that our comments were able to address the doubts and questions raised by the submission received.

**c) Comments on investment benchmark and accuracy of the investment analysis**

**Summary of the comments from Fearnside and International Rivers:**

Both Fearnside and the IHA criticise the benchmark used to for the demonstration of additionality. Fearnside says that the investor is free to choose any suitable higher benchmark and that *"the values appear to be essentially picked out of a hat"* and constructed on arbitrarily chosen variables and correction factors. IR declares that the CAPM used by the PP is obscure and *"does not accurately represent the actual hurdle rate of investors"*. In addition, both IR and Fearnside compare the benchmark used in the Jirau PDD with those used by other Project activities and argue that the benchmark used in the Jirau PDD is significantly higher. Furthermore, Fearnside also criticises the reference of the World Bank, which was used as comparator by the PP, not to be a credible reference. In complementation to this criticism, IR also cites investor announcements made by GDFSUEZ at the

time of the project starting date which declare that the projected return for the project is estimated to be about 12%, depending on the final Capex estimate and installation chronogram. As a consequence IR requests that the hurdle rate of the BNDES should be applied, rather than an equity investor specific benchmark.

Complementary to the doubts about the benchmark, IR also questions that the investment comparison including the E- policy is only being conducted with the "Base Case", which is the plant configuration that was considered at the project starting date, and not with the "Optimized Project" which is effectively being implemented. The argument made by IR is that the IRR return of the Optimized Project and under full consideration of the Brazilian Development Bank incentives would be higher than the benchmarks used by other comparable CDM projects and thus the project would show to be non additional.

**Background information to our responses:**

First we would wish to clarify that the benchmark used in the Jirau HPP PDD as calculated with the Capital Asset Pricing Model (CAPM) represents the cost of equity (Ke) in real terms as calculated for the project starting date. Investment Analysis and benchmark have been defined in line with the "Tool for the demonstration and assessment of additionality", here referred to as the *Additionality Tool* (Annex 21, EB65, 2011) and the "Guidelines on the assessment of investment analysis" here referred to as the *IA Guidelines* (Annex 5, EB62, 2011).

Therefore the benchmark calculated for the Jirau HPP is not comparable with the Weighted Average Cost of Capital (WACC) used by the Teles Pires Hydropower Plant Project Activity or the Santo Antonio Hydropower Project. The WACC used in the PDDs of the cited projects is an adequate benchmark to judge the return from the perspective of a project as a whole, while the Cost of Equity (Ke) is adequate to judge the return as calculated for the shareholder capital, i.e. the return on the share of project financed by equity and after full consideration of the debt financing, amortisation and interest payments. According to Guidance 12 of the IA Guidelines, both strategies are accepted, but it is important to compare like for like to avoid wrong conclusions.

Now as the WACC is calculated on the basis of the Cost of Equity (Ke) and the Cost of Debt it is possible to compare the Ke value calculated for the Jirau HPP with that used by the other project activities. As referenced by page 14 of the PDD for Santo Antonio, a Ke of 17.31% in real terms has been calculated. As the project starting date of the Santo Antonio project activity is about a year before the Jirau project activity, values are not directly comparable, but the benchmark was calculated to be in the same range of Jirau's Project Specific Benchmark..

In the case of the Teles Pires project activity, page 15 of the PDD indicates that the cost of equity was calculated to be 12.46% in real terms. Again this is not directly comparable as the project starting date of the Teles Pires project is in August 2011, more than three years after the project starting date of the Jirau CDM project activity.

In addition it is important to recognize that the Teles Pires projects considers a default financing rate of 50%, while the Project Specific Benchmark as calculated for the Jirau HPP considers a leverage of 70% as estimated at the time of the project starting date based on the indicative conditions published by the BNDES in April 2008. This project specific variable is also in line with the Feasibility Study Report which was submitted to the BNDES as basis for the project financing and compatible with the final figure finally agreed with in the loan agreement (68,5%).

Now as the increased leverage is effectively part of Brazilian Development Bank's investment incentives, it is part of the E- policy as discussed above. As a consequence the DOE requested to revise the benchmark to also reflect the baseline conditions which were defined for the additionality assessment, i.e. to adopt a standard leverage of 50% as offered for GHG intensive generation sources and which ignore the comparative advantage offered by the BNDES. Moreover, the use of a 50% default leverage is also in line with the Guidance 18 of the IA guidelines. PPs agree to this interpretation of the CDM rules and the Standard Benchmark for Baseline Conditions of 12,46% has been calculated and defined as appropriate additionality criteria of the equity IRR as calculated under baseline conditions, i.e. with a leverage of 50%. This value is now, as a matter of coincidence, exactly identical to the figure adopted by the Telles Pires Project. The PDD has been amended accordingly and the Project Specific Benchmark of 16,05% is only being used to illustrate how the investment incentives and the CDM contribute to make the project activity viable under the specific financial leverage conditions offered by the Brazilian Development Bank.

As a consequence of this simple correction and the applicable comparison we hope to have solved the doubt about any perceived conflict of the approach taken in the Jirau HPP PDD and other project activities. In fact the investment analysis for the Jirau HPP follows Guidance 10 of the Investment Analysis Guidelines, which means that the return on the Jirau HPP equity investment has been calculated after full consideration of the debt financing, amortisation and interest payments. Also, the calculation of the benchmark is based on parameters that are standard in the market and does not consider subjective profit expectations of any particular investor, as required by Guidance 13. This is further regulated by Guidance 15, which allows defining the cost of equity on the basis of simple default values offered by the IA Guidelines (and which will be discussed below), *"or by calculating the cost of equity using best financial practices, based on data sources which can be clearly validated by the DOE, while properly justifying all underlying factors".* Moreover now Gudiance 18 is being observed and a default leverage of 50% has been applied, which is in line with the standard financing conditions which the BNFDES offers to GHG intensive generation technologies. Based on these options and guidance and after due validation by the DOE a Standard Benchmark for Baseline Conditions of 12.46% has been defined as additionality criteria under baseline conditions, while a slightly corrected Project Specific Benchmark of 16,05% is only used to illustrate the importance of the BNDES incentives and the CDM to reach the project specific cost of equity.

To better understand the concepts behind the CDM rules which guide investment analysis and the definition of an investment benchmark, it is important to consider the fundaments of the financial theory and for reference we indicate Brealey and Myers (2003), Copeland, Koller and Murrin (2002)

and Damodaran (2002). The fundamental premise of financial theory and practice is the positive relation between the risk profile of an investment activity and the expected return. In the case of the Capital Asset Pricing Model, which is the most commonly used tool for the definition of the cost of equity, the return is directly proportional to the non diversifiable market risk of a specific investment activity. This proportionality is given by the Security Market Line. This follows the simple idea that any investor can simply buy and sell capital market instruments according to his risk profile and then gain the financial return which corresponds to the chosen allocation. Based on this premise, the minimum return for an investment activity is therefore defined as the opportunity cost of the funds, i.e. the yield which could be obtained by investing the money on the capital markets at a risk which is equivalent to the risk of the project activity. In other words, if a project yields a return which is equivalent to this opportunity cost, the investor should be indifferent to invest or not to invest in the project. Now as all market parameters fluctuate and evolve constantly, this opportunity costs is time depending and therefore has to be calculated at any specific point in time. This theory has been adopted by the CDM, which requires that the benchmark is to be defined by parameters that are standard in the market at the time of the project starting date.

According to Rocha (2006), who offers and excellent and very didactic introduction to the issue from the Brazilian perspective, the CAPM is the standard methodology to estimate the cost of equity, also for the purpose of regulation and it is used in countries like the UK, Australia, the US, Spain, Argentina and Chile. Now in the case of Brazil, the power generation sector is not regulated, but based on free competition and therefore a governmentally defined hurdle rate does not exist. In contrast, the electricity distribution business is regulated and the government does calculate and define the appropriate hurdle rate and the result can serve as a comparator. The economic rationale used by the regulator ANEEL, together with the applicable financial theory, is explained in detail by a technical note issued in March 2007 (ANEEL, 2007). This technical note and the values are result of a broad public consultation process and the value was defined to calculate distribution tariffs for the years 2007-2009 and therefore was valid at the time of the Jirau HPP project starting date. Nevertheless, as the variables and calculations represent the situation about 15 month before the project starting date the numbers are not completely compatible. In addition, ANEEL calculated the expected return on equity for the distribution business, which has a different risk profile than the generation business. For these reasons, both values are not directly comparable, but they obviously allow comparing and validating the approach taken in the Jirau HPP PDD.

As can be seen from the reference, the expected return on equity invested in the distribution sector is 13.75% and thus broadly comparable to the Standard Benchmark for Baseline Conditions (12,46%), or the Project Specific Benchmark (16,05%) as calculated for the Jirau HPP project activity. Differences are mainly explained by the different assumptions for financial leverage, which is assumed to be 50% in the case of Jirau's Standard Benchmark for Baseline Conditions and 70% in the vase of the Project Specific Benchmark, , versus a 57% average in the distribution sector. Another difference is that the beta for the distribution sector, which has regulated returns, is slightly lower that the beta of generation activities. In addition to that, ANEEL makes specific adjustments for regulatory and

exchange risks, which, if applied for Jirau would increase the benchmark. Another interesting reference and discussion of the value and assumptions made by ANEEL is offered by Rocha (2006). In her study she comes to the conclusion that different assumptions would lead to estimated required return on equity in the range between 13.4 and 15.4%. Again it is important to emphasize that these values are specific for the distribution business and not for investments in generation activities, but they illustrate the use of the CAPM in the context of the Brazilian reality.

In addition, considering that the distribution business earns a regulated return of 13.75% for equity investments, this represents an interesting opportunity cost for any investor as he could always invest in the distribution business instead of the more risky generation business. To assume a lower benchmark for hydropower investments would thus not be reasonable. In fact, as already cited before (World Bank, 2000) hydropower investments have a very specific risk profile, which require an increased expected rate of return to compensate for this risk. Some examples for such risks are cost overruns, construction delays, difficulties with Environmental Licensing, geological risks. With a specific reference to the risks, costs and difficulties for environmental licensing, the World Bank study has cited that a return of approximately 15% is required by an equity investor to invest in such project activities, but the same number is also cited to be the expected rate of return in the Brazilian energy sector by another more recent study about the Economics of Climate Change in Brazil (Economia do Clima, 2010).

Now when it comes to the question in relation to the investor pronouncement of GDFSUEZ on 30 May 2008, where a 12% return was cited as projected return from the investment, depending on the final Capex estimate, anticipation of the construction timeline and other variables. To understand this figure it is important to consider that this is not an investment benchmark, but the probable outcome as calculated on the basis of scenario analysis, which represents a more advanced technique of investment analysis where values and assumptions are varied around certain estimates. Given the uncertainty of many of the variables that define the Base Case as defined in the project PDD, especially considering that they were estimated according to their most ambitious value (maximum revenues and minimum cost estimates), which is conservative in terms of the CDM, the results obtained by this benchmark analysis represent the most positive outcome if all assumptions are fulfilled.

On the other hand, the 12% figure mentioned should hold if, for example plant commissioning is delayed, Capex is increased or CER prices are lower than estimated. Such a scenario analysis is not foreseen under the CDM rules, which require that investment analysis shall be developed on the basis of assumptions which are conservative in the terms of the CDM, i.e. maximize the investment return. Furthermore, the Additionality Tool explicitly requires that *"the financial/economic analysis shall be based on parameters that are standard in the market, considering the specific characteristics of the project type, but not linked to the subjective profitability expectation or risk profile of a particular project developer."*

The fact that this 12% rate which represents the average projected return would be an inappropriate benchmark for a standard investment analysis as required for the discussion of the Jirau HPP project

additionality is also evident when analysing the assumptions which were made by the Meth Panel to define a default equity benchmark, as detailed in the Information Note "Default Values for equity return of CDM projects". This document has been taken note of by the EB as a basis for the definition of the default values of the cost of equity which are offered by the IA Guidelines for PPs that do not want to define a Project Specific Benchmark. For the Brazilian Energy Sector a Default Benchmark of 11,75% was defined, which is roughly comparable to the 12% mentioned above. Now when analysing the premises that were made by the Meth Panel to define this default value, there are two fundamental reasons which require a more specific approach for the Jirau HPP project activity:

i) **On page 9 the Information Note explains:**

*Studies show that equity returns on utilities sector are historically lower than industrial sector since they are regulated and guaranteed by regulatory body.* ***Historically in utility sector there has been no competition and it is a natural monopoly.*** *Only in the developed countries, in recent years, by liberalizing power production and marketing has been made competitive.* ***However in most developing countries, utility sector is still treated as monopoly with a guaranteed return. For these reasons, utility returns are less than industry returns.***

In fact this does not apply for the liberalized Brazilian energy generation business where agents have to compete in a free market and where no minimum returns are being granted by the state or regulator. To the contrary, any cost overrun or delay has to be borne by the generator and energy sales under the regulated or liberalized market have to be honoured on the basis of firm financial guarantees. For this reason the 1% downward adjustment made by the Meth Panel is not justified in the case of energy generation projects in Brazil.

ii) **On page 14 the Information Note explains:**

*"To apply the new default equity values, [...]* ***cash flow needs to be computed based on 100% equity to ensure consistency."***

This situation does also not apply for the Jirau HPP as the project is financed up to 70% by the BNDES and, due to the high capital requirement, would not make sense from a pure equity perspective. As shown in the PDD, project financing is necessary to make the project viable and the low interest rates offered by the BNDES are necessary to raise the equity return to a level which offers acceptable returns. On the other hand this increases the equity investor's risk and therefore expected return as referenced by the financial literature already cited above.

In spite of these considerations which show that the approach taken in the Jirau HPP PDD as published for GSC, apart from some corrections that were necessary on the basis of the DOEs findings, were correct according to the rules of the CDM we would like to demonstrate that even if considering the Default Benchmark as defined by the IA Guidelines, the project requires CDM revenues to be financially feasible. The respective amendments have been made in the PDD and clearly show that,

without CERs neither the Standard Benchmark for Baseline Conditions of 12.46%, nor the Default Benchmark of 11.75% is reached. This is not only true for the Base Case and the Optimized Project under baseline conditions, but also if the full investment incentive is considered for both perspectives. In fact even if the Optimized Projects is evaluated on the basis of full consideration of all investment incentives offered by the Brazilian Development Bank, without CERs the equity IRR reaches only 10.9% and therefore does not meet the Default Benchmark and much less the project specific investment benchmark.

Finally we would like to address the suggestion that the investment analysis should be conducted on the basis of the Optimized Project, which is the configuration which is effectively being implemented.

As described in the PDD, the investment assumption at the project starting date was to develop the Jirau HPP with 46 turbines and an installed capacity of 3.450 MW, which was already above the government's original proposal of 44 turbines and 3.300 MW. This fact is referenced by the Feasibility Study Report which was submitted to the BNDES in June 2008, by the Notification on CDM consideration submitted to the Brazilian DNA and to the UNFCCC, validation offers that were received in 2009, as well as by numerous presentations and press releases originated by the BNDES and ESBR, as well as independent journalists. Now according to the CDM rules (Guidance 6) the Investment Analysis should be valid and applicable at the time of the investment decision i.e. the project starting date, which in the case of the Jirau HPP was in June 2008 when ESBR started to develop the Jirau HPP project with 46 turbines at the Ilha do Padre. As all documents available at that date demonstrate, at that time ESBR did not consider nor have information about the possibility to implement 50 turbines. Nevertheless, to demonstrate that even in the case it would have known and considered such an expansion, the project would still require CDM revenues to be financially attractive; this specific scenario has been included in the investment Analysis.

**Conclusion and responses to the comments from Fearnside and International Rivers:**

i) The project specific cost of equity (ke) under consideration of the project specific leverage as estimated on the basis of the Brazilian Development Bank's financing conditions or under standard market and default leverage conditions which apply for the baseline, has been calculated on the basis of a standard CAPM and in line with the applicable CDM rules and guidance. An accurate like for like comparison (ke in real terms) with other CDM projects and applicable literature shows that the results are fully comparable and any minor variations are explained by different time related datasets, leverage assumptions or slightly different risk profile of the activities analysed. Furthermore, we have cited references that show that the CAPM is a standard method for the estimation of the market based cost of equity and we have cited literature that shed light on the fundaments of sound financial theory and practice. We therefore hope that the doubts about any obscure and arbitrary practice for the determination of the investment benchmarks have been solved. Further we hope that the questions about the value of the World Bank publication, as comparator for Jirau's project specific equity benchmark, have been satisfied on the basis of the fact that the same value is also cited by

other references of reputed origin. Also it is well in line with other technical and regulatory publications;

ii) Following a clarification request from the DOE, the investment benchmark for additionality discussion has been revised to consider a standard financial leverage of 50% which is effectively more appropriate to judge the project's additionality under baseline conditions and which complies with Guidance 18 of the IA Guidelines. As a consequence of this revision a Standard Benchmark for Baseline Conditions of 12.46% has been adopted as general additionality criteria.

iii) In response to the question about the projected return of 12% for the Jirau project activity as cited in a interview back in March 2008 we have clarified that this is not a benchmark for investment decision, but the result of a scenario projection where different assumptions in relation to anticipation, lower CER prices and higher investment costs are taken into account. Such a scenario analysis is not foreseen and allowed under the CDM, but it is a PP internal measure to project the expected outcome of an investment in more conservative scenarios which are adequate to communicate to investors. Such "conservative scenarios" are not accepted by the CDM. We also wish to remind that the CDM does not allow using investor specific assumptions and investment criteria to discuss additionality of projects which are open to any investor;

iv) In relation to the request to compare the equity IRR as calculated for the project activity with a benchmark defined by the Brazilian Development Bank, we regret to inform that such a rate does not exist. The BNDES, as third party financier, considers the Debt Service Coverage ratio to be the relevant criteria to define and quantify the degree of financing. This DSCR has been duly taken into account to elaborate the investment analysis;

v) In any case, and to satisfy the request to compare the calculated equity IRR with a more conservative benchmark, we have now also included the comparisons and calculations with the default equity benchmark of 11,75% as defined by the IA Guidelines. To understand the value of this comparison in complement to the Standard Benchmark for Baseline Conditions Project Specific Benchmark, we have shown that this Default Benchmark is not applicable for the Jirau HPP project activity due to the fact that the Jirau HPP does not earn a regulated return of investment. In addition, when comparing it to the Project Specific Benchmark, which was calculated with a leverage of 70%, we have shown that the Default Benchmark is also not comparable because it does not take into account the increased risk which arises from financial leverage. These two features are not compatible with the premises for the definition of the Default Benchmark as it is valid for 100% equity financed projects that are developed under a regulation which offers a guaranteed return on investment. Now as the results clearly show that the project is also financially additional in comparison to this conservative benchmark;

vi) To address the suggestion of International Rivers to disclose the rate of return for the "Optimized Project" in order to allow a comparison with the benchmark and for the sake of transparency we have included this value in the PDD. Nevertheless we wish to remind that this is not a requirement of the CDM as the PP is only required to discuss the additionality of the project activity without the CDM and without the comparative advantage created by E-regulation. In addition, investment analysis shall be conducted from the perspective of the project starting date and should not take into account any later changes in project design or costs. Now to fully understand the results it is important to remind that the decision to implement the Optimized Project was taken in August 2011, under full consideration of CDM revenues. Nevertheless, for the purpose of transparency the PDD presents the hypothetic scenario that this optimisation and therefore positive evolution would have been known at the project starting date. In addition, the Optimized Project considers the highest technically possible load factor, even if not recognized by the regulator. On the other hand, negative evolutions, like cost overruns not related to the incremental installed capacity, the delays in the construction process are being ignored to address any request of conservativeness. If, as requested by IR, the project would be evaluated under the current and effective situation it would show more additional than at the project starting date.

**d) Comments and Questions in relation to project emissions**

**Summary of the comments from Fearnside:**

Fearnside generally criticizes the CDM as well as the Brazilian Government for considering hydropower plants to be as clean energy generation sources due to methane emissions from the reservoir. Though Fearnside recognized that methane emissions are reduced for small reservoirs, he criticises the CDM criteria of Power Density which allow neglecting methane as minor emission source for plants where the relation of installed capacity to the flooded area is higher than 10 $W/m^2$. Fearnside further recognized that the high water flow rate through the reservoir at Jirau will result in lower emissions than in other Amazonian dams, but that emissions would not be zero. Subsequently, Fearnside engages into a detailed discussion about the fact that the EIA considers the Jirau HPP reservoir not to be stratified due to the high turnover time and he identifies that some stratification at the reservoir's edges is expected by some authors. Fearnside further cites a personal communication which alleges to have identified stratification with anoxic bottom waters in the flooded mouth of two of the tributaries which enter the new reservoir. With such areas he expects that some methane is emitted through the surface, without the formation of bubbles, and that most of the portion of this dissolved methane would then be prevented from reaching the turbines due to oxygenated water in the main channel.

Furthermore Fearnside criticizes the CDM rule for Power Density to contemplate only additionally flooded area, while the natural river bed is excluded from the calculation. In his view this is wrong as the surface of the natural river bed will also generate methane emissions.

**Background information to our responses:**

The discussion around Greenhouse Gas (GHG) Emissions from freshwater reservoirs continues to be an important issue and as cited above, the Brazilian government has taken important and explicit steps to minimize the risk that such emissions arise from the implementation of new reservoirs by focusing on the development and offering of concessions for run-of-river reservoirs with high power density (Bezerra et al, 2010). EPE, 2007 is clear by considering this as a trade-off which leads to loss of generation capacity, while on the other hand this opens the opportunity to obtain CDM financing for such projects. We therefore have to recognize that once again, the Brazilian government made energetic and economic concessions in benefit of the global good of GHG mitigation.

Now when analysing the status of this discussions, it is of interest to consider that Fearnside's submission, as well as his articles and other references used (Abril et al., 2005; Fearnside, 2002, 2005a,b; Kemenes et al., 2007, 2011), base the argument that reservoirs in the Amazon are a significant source of high gross GHG emissions on few very specific examples of hydropower reservoirs with large shallow reservoirs and low energy production and therefore low Power Density factors, such as Petit Saunt (Power Density = 0.4 $W/m^2$) Balbina (Power Density = 0.09 $W/m^2$); and Tucurui (Power Density = 1.63 $W/m^2$). These chosen plants and therefore the studies derived from them are not comparable to modern run-of-river hydropower investments such as the Jirau HPP project activity. In addition to this bias of choosing non representative examples, the discussion is being hampered by the fact that these studies generally measure gross GHG emissions, which means that they neglect the fact that any sweet water course, natural or manmade, may act as a source of GHG emissions, which means that not all GHG emissions measured at a manmade reservoir can be attributed to the project as part of these emissions would have been generated also in the absence of the project. Now even recognizing the overestimation that the contemplation of considering gross GHG estimation implies, Santos et al (2006) have made a comparative study which shows that the Power Density factor is a meaningful proxy to identify hydropower plants with negligible gross GHG emissions when compared to fossil fuel energy generation options.

Since then the progress of the discussion, as well as the fundamental principle that only net GHG emissions shall be taken into account was recorded by IPCC (2011), which defines net GHG emissions from freshwater reservoirs as those *"excluding unrelated anthropogenic sources and pre-existing natural emissions"*, and asserts that: *"the assessment of man-made net emissions involves: a) appropriate estimation of the natural emissions from the terrestrial ecosystem, wetlands, rivers and lakes that were located in the area before impoundment; and b) abstracting the effect of carbon inflow from the terrestrial ecosystem, both natural and related to human activities, on the net GHG emissions before and after impoundment."*

Therefore, to make constructive progress in this discussion, a more representative analysis of the scientific literature has to be taken into account. Such an analysis shows that it is not correct to classify hydropower projects as a general source of significant net GHG emissions and that there is increasing evidence that life-cycle emissions of hydropower, are in fact very low.

Such solid results are derived from recently developed knowledge which shows that reservoirs emissions are significantly smaller than previously estimated (Barros et al., 2011; Chanudet et al., 2011), while the terrestrial GHG sink may be smaller than currently believed (Bastviken et al., 2011). Also, new studies show that tropical and sub-tropical reservoirs can behave as carbon sinks (Sikar et al., 2009; Chanudet et al., 2011; Ometto et al., 201?).

A representative literature review for Life Cycle Emissions (LCA - Life Cycle Assessments) of hydropower and other energy sources has been conducted by the IPCC (2011) to assess GHG emissions from reservoir and run-of-river hydropower plants. The study is clear by expressing that *"The LCAs evaluated in this assessment only accounted for gross LUC(Land Use Change)-related emissions. Characterizing a reservoir as a net emitter of GHG implies consideration of emissions that would have occurred without the reservoir, which is an area of active research"*. Now, in spite of this limitation, the IPCC as identified hydropower and especially run-of-river plants to have the lowest GHG emissions of all commercially available electricity generation sources, including wind and solar. Graph 9.8 of the publication is replicated below in Figure 4. The comparison is also interesting because it shows the increased advantage of hydropower from the perspective of Life Cycle Assessments where the emission intensities of Gas, Coal and Fuel oil generated electricity are significantly higher than the emission factors which are used to calculate the emission reductions which are calculated and certified on the basis of UNFCCC methodologies. Though this is an obvious fact due to the large direct (coal mine gas, flaring and venting of natural gas and associated gas) and indirect emissions (production, transport, refinery) related to the production of fossil fuels, this issue (and therefore this benefit of renewable energies) gains only reduced attention while the discussions around GHG emissions from hydropower plants is emphasized without taking the recent scientific progress adequately into account.