The Risks of Investing in Large Hydro in the Amazon

Investing in large hydroelectric dams in the Amazon presents possibilities for cost overruns associated with social and environmental risks, construction risks, legal risks, and financial risks. For projects of the magnitude of large dams, financial risks should be estimated as precisely as possible to minimize the chance that even small miscalculations could result in severe and irreparable losses to entrepreneurs, investors, financiers and society in general.

Among others, the risks of investing in large hydro projects in the Amazon can include:

Mitigation and Operation risks: Environmental risks

- The costs of environmental flows maintenance, especially during the Amazon's dry season, aggravated by climate change;
- The costs of reductions in reservoir storage, especially during the Amazon's dry season, aggravated by climate change;
- The costs of reductions in hydrological quality;
- The costs of reductions in fish stocks;
- The costs of impacts on biodiversity, including the costs of species extinctions;
- The costs of greenhouse gas emissions, especially reservoir-emitted methane;

Social and human rights risks:

- The costs of impacts on indigenous peoples and traditional peoples, including risk of displacement and relocation;
- High risk of violation of rights to lands, territories and resources, consultation and numerous other recognized rights of indigenous peoples
- Risk of increased conflict over land and resources, due to increased land pressure associated with displacement
- The costs of direct harm and displacement, in the case of flooding associated with reservoir creation;
- The costs of indirect harm and displacement, in the case of desiccation associated with river diversion;
- The costs of improvement to urban infrastructure associated with increases in rural-urban immigration;
- The costs of pressure on forest resources associated with increases in rural immigration;
- The costs of increased tropical disease transmission associated with increases in rural-urban immigration;

Legal risks:

- The costs of litigation, especially associated with illegalities in the licensing process;
- The costs of reputational risks, especially associated with international civil society campaigns to protect human rights and the environment and negative media exposure;

Construction risks:

- The costs of delays in construction timeframes;
- The costs of low turbine productivity;
- The costs of transmission line construction;
- The costs of transmission losses due to inefficiencies;

Financial risks:

- The costs of high credit risk, associated with the inability of recipients to pay back loans;
- The costs of increases in the real interest rate, associated with inflation;
- The costs of monetary risk, associated with changes in the market values of currencies used to denominate financial transactions;
- The costs of commodity risk, associated with changes in the market values of commodities produced using hydroelectricity, such as metals and agricultural products;

Case study: The Mega Risks of the Belo Monte Complex

Special care should be taken in the assessment of risk and economic-technical viability in unusual cases such as that of the Belo Monte Complex, which involves an unprecedented level of subsidized financing from public banks, major investments of state pension funds, and guarantees made through the issuance of debt securities of the Federal Treasury, in addition to private financing.

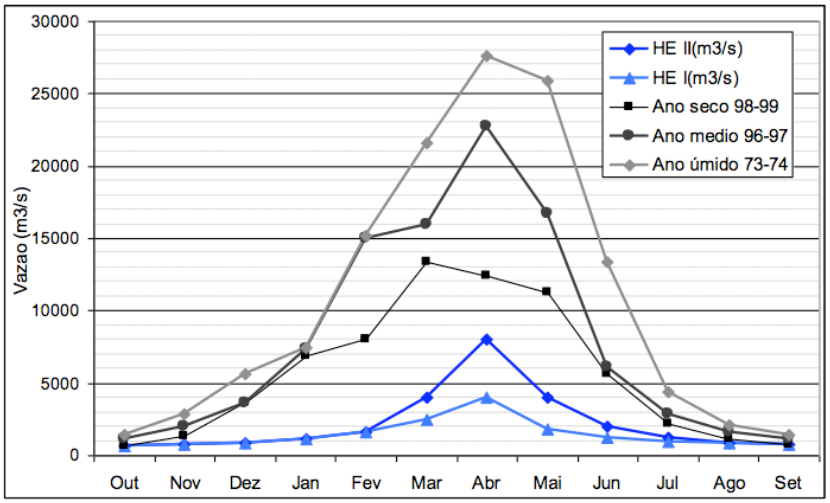

Figure 1. Two scenarios, HE I and HE II (in blue), of the projected flow on the Xingu river after project operation takes effect, compared with the regular seasonal flows of the river during recorded years of low, average, and high precipitation (Odebrecht, 2008).

Hidrogramas	Out	Nov	Dez	Jan	Fev	Mar	Abr	Mai	Jun	Jul	Ago	Set	Med
HE I(m3/s)	700	800	900	1100	1600	2500	4000	1800	1200	1000	900	750	1438
HE II(m3/s)	700	800	900	1100	1600	4000	8000	4000	2000	1200	900	750	4501
Ano medio 96-97	1125	1959	3590	7353	15047	15973	22744	16711	6114	2865	1598	1172	8021
Ano seco 98-99	715	1378	3643	6867	7992	13361	12416	11274	5594	2225	1100	778	5612
Ano úmido 73-74	1418	2834	5617	7455	15161	21551	27567	25927	13396	4434	2056	1444	10738

Grave omissions made during the process of environmental licensing of the Belo Monte Complex, relating especially to the economic and technical inviability of the project, have led to a series of political resignations, lawsuits, and reputational risks for investors.

Inefficient and expensive design

"Belo Monte is the worst engineering project in the history of Brazil"-- *The Journal of the Brazilian Engineering Institute*

The current design of Belo Monte is inefficient as well as expensive. Reductions in the size of the original project, and the project's current generating capacity, reveal grave inefficiencies that call attention to its economic inviability, in the case that additional dams are constructed upstream.

Belo Monte will divert more than 80% of the Xingu River's flow in order to move the turbines situated in the principal power house. The "Big Bend" of the river, located downstream from the proposed site of the secondary Pimental power house, will see its flow reduced from well over 20,000 cubic metres per second (m3/s) to between 4,000 and 8,000 metres per second during the rainy season, depending on the amount of water released to maintain environmental flows, and as little as 700 m3/s during the dry season (Figures 1 and 2).

Figure 2. Recorded monthly flow data of the Xingu River, and the two projected scenarios of reduced flow during hydroelectric operation, in cubic meters per second (m3/s), (Painel de Especialistas, 2009).

The large variation in flow of the Xingu River will generate a scenario in which only a few turbines will generate electricity during the dry season. Indeed, in years of drought or very little precipitation, it is possible that no electricity will be generated at all. Simulations have illustrated the inefficiency of the dams in terms of guaranteed physical capacity, equivalent to only 39% (4,420 MW) of the dam's stated installed capacity (11,233 megawatts - MW). The average capacity of the dam is unknown, as it depends entirely upon the yearly flow regimes of the Xingu River.

The only way to compensate for the low generating capacity of Belo Monte relative to its stated installed capacity would be to regulate the flow of the Xingu upstream, through the construction of additional dams to


Photo Credit: International Rivers

form reservoirs with greater storage capacity. As such, the project could anticipate a second phase in which additional reservoirs are built, including the Altamira Dam (formerly called Babaquara Dam), which was projected in Alternative B of the 2002 Belo Monte Complex Environmental Impact Assessment (EIA). Altamira Dam, and other upstream dams, would provoke much wider social and environmental impacts for the populations and ecosystems of the region, and would directly flood indigenous Kayapó populations whose lands are located in the modelled reservoir area.Low ReturnsDue to the highly uncertain construction costs, low generating capacity related to the hydrological characteristics of the Xingu river, uncertainties in mitigation and compensation costs, and uncertainties in market values over the next few years, the Belo Monte Complex has an elevated risk of generating low dividends, or to even become a liability. Accordingly, returns on the project will decrease as the total costs of implementing it increase. Economists have modeled the project's dividends on various occasions. In April 2010, Banco Santander published a study in which it simulated returns between 6% and 10%. The study considered two scenarios, the more realistic of which calculated a capital expenditure (CAPEX) of R$24 billion (USD $14 billion), of which the Brazilian National Development Bank would take on a debt of 70%, or equal to a total of 25% of its patrimony. The study estimated an average energy price of R$84/MWh, assumed to take into account the price on the regulated public market (R$77.97/MWh) and the unregulated free market (R$110/MWh)(Banco Santander, 2010).

However, further studies have modeled poorer dividends on the project. Silvestre Leitão and Sousa Júnior (2004), and Sousa Júnior and Reid (2010) provided models that include additional cost information not considered by the Santander study. Additional costs include losses to fisheries, the cost of greenhouse gas costs from construction and reservoir emissions, losses in water quality, losses in operation efficiency due to reservoir evaporation, and losses to the tourism industry, among others.

In contrast to the Santander study, Sousa Júnior and Reid (2010) calculated lower dividends. In its first scenario, this study projects the Belo Monte Complex to lose USD $8 million, even while based on a conservative CAPEX of R$20 billion (USD$12 billion), a construction period of 5 years, and an average energy price of R$78/MWh. In its second scenario, the study includes additional costs, such as those listed above, and projects the Belo Monte Complex to lose close to USD $7 billion, based on a CAPEX of R$33 billion (USD $20 billion), a construction period of 10 years, and a lower average energy price of R$65/MWh. In both scenarios, the cost of social and environmental mitigation remains equal, at R$1.4 billion (USD $850 million).

Lawsuits and the Inviability of Licensing

Ten lawsuits currently exist that may potentially delay or outright paralyze the Belo Monte Complex. The lawsuits refer mostly to irregularities during the project's environmental licensing process, in addition to violations of rights, such as those of indigenous peoples who would be impacted by construction.

IBAMA officials responsible for the licensing of the Belo Monte Complex have resigned in protest of the political pressure to approve the project despite its inviability, including the institution's President, Abelardo Bayma Azevedo, who resigned from his post in January 2011. In a report from O Globo, "in meetings with Eletronorte directors, Abelardo refused to grant the definitive license [for Belo Monte]. He argued that IBAMA could not grant the license because the project was still full of pending environmental problems."

Similarly, in September 2009, two senior IBAMA technicians assigned to the Belo Monte Complex, Leozildo Tabajara da Silva Benjamin and Sebastião Custódio Pires, resigned from their posts after citing high-level political pressure to approve the project despite large omissions in the EIA. These resignations have caused serious divisions within the agency.

In 2009, the technical team assigned to the Belo Monte Complex at IBAMA declared that "there are insufficient elements to attest to the environmental viability of the project" due to the omission of data in the EIA. The EIA lacked data on water quality, socioeconomic indicators, and impacts on fisheries, while consortium Norte Energia, S.A. provided no evidence of plans to mitigate the project's direct impacts on riverine families.

Increasing Credit Risk

BNDES states that the credit risk of its projected loans for the Belo Monte Complex ranges between 0.46% and 2.54% yearly. However, these values depend both on Brazil's nominal interest rate (the SELIC rate), which is expected to continue to rise in 2011 after the Brazilian Central Bank recently (January 2011) raised the rate by 50 percentage points to 11.25%, and on BNDES' classification of the project risk, which is not currently public information.

The risk classification model at BNDES has recently been revised, and categorizes loans within a matrix of A, B, or C, in function of the projected adverse impacts of a project. However, as of January 2011, BNDES has not made public its methods of calculating the Belo Monte Complex's credit risk, nor has it published its classification of project risk. This lack of transparency and closed access to information indicates a concern that BNDES does not count on a rigorous methodology for project risk assessment, and that the bank has not considered all of the factors of risk and cost during its project evaluation.

There are, nonetheless, strong indications that the Belo Monte Complex has been categorized as a high risk investment. One of them is the passage of Medida Provisória MP 511, which permits the Brazilian National Treasury to provision R$20 billion (USD $12 billion) to back any loan disbursed by BNDES, including its loans to fund the Belo Monte Complex. The effect of MP 511 is to reduce any loan's credit risk rating, in the event that a project is classified as high risk.

Photos courtesy of Amazon Watch, International Rivers and the Rainforest Foundation UK