

Brazil's Belo Monte Dam: A Hydropower Dilemma

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Throughout the Xingu river basin, Antonia Melo da Silva is seen as a tireless warrior and beacon of hope. The Belo Monte Dam took her home, her livelihood, and her happiness. To this day, she still remembers the day the bulldozers arrived in her community. The fear that took root inside her and all her loved ones was incomparable, but one they soon learned to live with. Unwilling to leave anyone behind, Silva made sure everyone had a place to go before she packed up her family and said her final goodbyes to the land of her ancestors. She left, but she did not remain silent in the face of such injustice.

The dam brings death to the flora, the fauna, countless indigenous and traditional cultures that live in the Xingu basin. Our people face increased violence, unemployment and misery because the government and a group of investors want to exploit our land and rivers for profit. I dedicated my life to campaigning against this project, and though it has gone ahead, I will keep on fighting against what Belo Monte represents: a destructive, unsustainable and unfeasible development model. (Silva, 2017)

Silva created “Movimiento Xingu Vivo Para Sempre” over twenty years ago. Recently, Silva was awarded the 2017 Alexander Soros Foundation Award for her activism. The question Silva now faces is how to allocate funds in order to further the foundation’s missions. To determine the best move forward, she decided to take a holistic approach into understanding Belo Monte and the hydropower dilemma Brazil is facing.

Hydropower in Brazil

Energy is one of Brazil’s greatest barriers to development. With a rapidly growing population of 207 million, the demand for energy far exceeds production. Based on current estimates, generating capacity needs to increase by approximately 5 to 7 GW to satisfy growing demand on a yearly basis (Buckley, 2012). As such, Brazil is faced with a pressing energy challenge.

The electricity sector in Brazil is the largest in South America and 97% of the total population has access to electricity (The World Bank, 2014). In the past two decades, Brazil has been transitioning from nonrenewable to renewable energy sources. Currently 76% of its electricity is generated from renewable sources (Álvares, 2007). According to Brazil’s Ten-Year Energy Expansion Plans, the aim is to raise this percentage to 86.1% by 2023. Experts believe Brazil is well on its way to achieving this goal (Cabré, 2017).

About two-thirds of Brazil’s renewable electricity generation comes from hydropower. Much of Brazil’s hydroelectric potential lies in the country’s Amazon River Basin. According to the *Associação Brasileira de Distribuidores de Energia Elétrica* (ABRADEE), Brazil has 158 hydroelectric plants in operation, 9 plants in construction and another 26 authorized to be built (Álvares, 2007). The majority of these hydroelectric plants have installed capacities between 1 and 3 MW (Álvares, 2007). However, the Itaipu Dam in the Parana River has an installed generating capacity of 14,000 MW (Fearnside, 2012). It is the second largest hydroelectric power plant in the world behind the Three Gorges Dam in China. According to the Brazilian Ministry

of Mines and Energy, Brazil will aim to increase hydropower capacity by 27 GW by 2024 (Minas e Energia, 2017). With the Belo Monte Dam, this will not be a challenge.

Energy Challenge

Today, the controversial hydroelectric challenge Brazil is facing regards the Belo Monte Dam that is currently under construction in the Xingu River Basin. On February 17th 2016, the Belo Monte Dam tested its first turbine (Southgate, 2016). With a planned finish date in 2019 and an installed capacity of 11,233 MW, the Belo Monte Dam is projected to not only catalyze economic growth, but to also expand access to electricity into isolated regions (Southgate, 2016). However, a host of economic, political, social, and environmental concerns associated with the construction of the dam have gained prominence.

With the future of Amazonia and all of the actors involved at risk with the continuing construction of the Belo Monte Dam, Brazil must try and find a harmonized balance between the three sustainability pillars: economic/political, social, and environmental. The dilemma is as follows:

1. Is the compromisation of one of the sustainability pillars inevitable in the construction and eventual generation of the Belo Monte Dam?
2. If so, do any alternatives to hydropower exist?

In order to contextualize these questions, the political, economic, and social environment of the Belo Monte Dam project must be examined. As an important stakeholder, “Movimiento Xingu Vivo Para Sempre” is uniquely situated to focus attention and resources into the best approach to addressing this energy challenge.

History of Belo Monte Dam

The timeline of the Belo Monte Dam has shifted the landscape of this contentious project for over five decades. Plans to dam the Xingu River date back to Brazil’s military dictatorship in the 1970s. As democracy was being restored to the nation in the 1980s, Brazil's state energy company, Eletrobrás, announced an ambitious plan to build six large dams on the Xingu River. The dam project was predicted to cause massive flooding of indigenous lands. As a result, the World Bank suspended funding for the project, crediting protest efforts by indigenous people.

In 2003, the Brazilian government unveiled a revamped version of Belo Monte and Brazil’s president at the time, Luiz Inácio Lula da Silva, urged his ministers to approve it. The project was authorized by a legislative decree, but lacked prior consultation with indigenous groups. Subsequently, indigenous groups fought back.

In 2008, indigenous activism forced the government to write and sign a resolution that would not only reduce the number of dams, but also promise no future upriver dam projects. IBAMA, Brazil's environmental agency, granted an initial license for the project even after the dam was criticized for its social and environmental risks. Despite huge criticism from human rights organizations, the project pushed forward with North Energy, Brazil’s energy mogul, leading the way in construction. Construction was suspended on occasion due to legal charges, but government-friendly judges repeatedly overturned any suspensions. Moreover, the history of the Belo Monte Dam is fraught with controversy and legal battles that are still continuing today.

Project Design

Construction of the Belo Monte Dam began in Altamira during 2011. Although still in construction, the dam is currently composed of two parts. One portion powers the main turbine while the other diverts the course of the river into two man-made reservoirs. In total these reservoirs cover an area of 668 km² which used to be home to thousands of indigenous people (International Rivers, 2016). The dam was functional by 2015, but projected to be up and running at full capacity by 2019 (Bratman, 2014). The project is currently suspended from further construction due to legal accusations pertaining to housing inadequacy of indigenous people. Brazil's energy mogul "Norte Energia has been accused by the Federal Public Ministry of ethnocide for its wholesale destruction of indigenous culture" (Sullivan, 2017, n.p.). Construction suspension of this project is nothing new as the political influence is backing the full operation of the Belo Monte Dam. Despite costing taxpayers \$30 billion Brazilian reais (four times the initial budget), proposed construction of additional dams upstream are in discussion to make up for the inadequacy of the dam's current energy generating capacity (International Rivers, 2016).

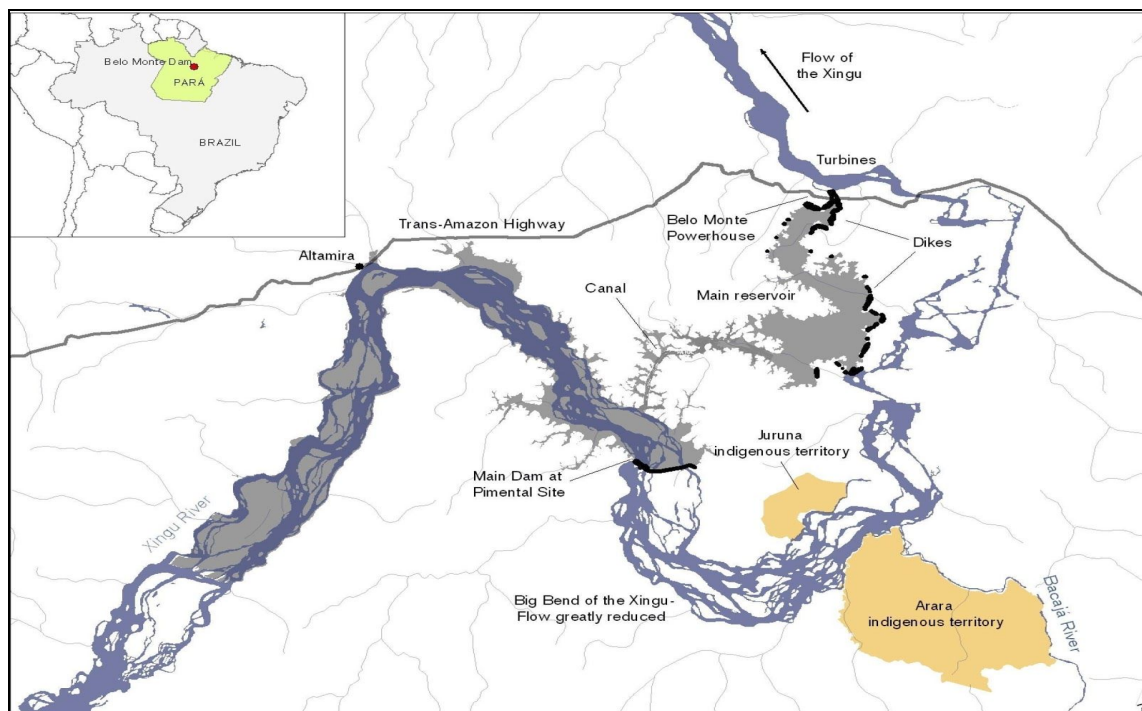


Figure 1: Belo Monte Hydroelectric Project

Map of Belo Monte Hydroelectric Project. International Rivers. (2012). Map of Belo Monte Dam. <https://www.internationalrivers.org/resources/map-of-belo-monte-dam-4595>.

Economy

The Belo Monte Dam, when fully built, would provide a power output of 11,233 MW. However, even with this massive capacity, the dam will only produce an average of 4,571 MW yearly. A capacity factor of 40.7% is low, but not altogether terrible for large scale dams (Fearnside, 2012). The low capacity factor is due to limited water availability during the dry season.

Despite various legal setbacks, Belo Monte has the backing of the Brazilian government and is being developed by state-owned power company Eletronorte. This project was projected to cost US \$13 billion, and a majority of funding came from national development banks and government spending funds. The National Development Bank (BNDES) committed to finance up to 80 percent of the project, and elected to give a 30-year grace period on loan repayment. On the contrary, private investors have been hesitant to invest in Belo Monte due to the upheaval surrounding the project (International Rivers, 2010).

The project has the capacity to provide power to 18 million homes (Leite, 2013). Because of Brazil's heavily subsidized aluminum industry, a large portion of energy produced would be diverted into the industrial sector. This would not only fail to provide power to the people of Brazil, but also work to offset several of the proposed "green energy" benefits of the project (International Rivers, 2009). Considering the high economic cost of the construction of the dam, as well as the continued struggles in the courts, the foreseen cost for Belo Monte has increased significantly. This leads to a problem in the ability of the dam to eventually generate positive profit. Based on several research models, it becomes apparent that the Belo Monte project will likely have net negative profit over the next 50 years (The Economist, 2017).

Policy

Since 2002, Brazil has been in the hands of the Partido dos Trabalhadores (PT), a left leaning party that claims to have the best interests of the Brazilian people in mind. In 2002, Luis Inacio Lula da Silva, more commonly referred to as Lula, won the presidential election amidst growing concern over Brazil's spiraling economy. In an effort to prove his dedication to national economic needs, Lula reinstated the previously defeated Belo Monte Hydroelectric project. His hope was to catalyze development for the Brazilian people. When Dilma Rousseff, Lula's hand-groomed successor, took charge, the official support towards Belo Monte continued to increase and gain momentum. This continues to be very much the case today. Recently Dilma Rousseff was impeached for corruption charges placing Michel Temer in charge of the country, who himself is now also facing corruption charges and impeachment.

No project has received more political fallout than the Belo Monte Hydroelectric Project. Top political officials, including judges that helped push Belo Monte through political loopholes, have since been removed from office, either through termination or resignation, in the face of corruption scandals (Perez, 2015).

Society

As discussed previously, the Belo Monte Dam project has numerous political and economic impacts. However, what goes largely unnoticed, internationally, is the tremendous social impact this project has on indigenous populations. The Belo Monte hydroelectric project is paving the way for dams that will displace large numbers of indigenous people from their homes. If removed from their land, these people will see their livelihoods, culture, and legal rights threatened. They will not only lose access to the abundance of foods and plant medicines that nature has provided to them for centuries, but it will also sever their connection with the land that, since the time of their ancestors, has been the basis for their cultural and spiritual beliefs. Overall, the Xingu river is given reverence by native peoples and is considered sacred.

To begin with, the culture and livelihoods of indigenous people of the Xingu Watershed have been threatened by the construction of the Belo Monte Dam. There are fifteen different

tribes that inhabit the Xingu River Basin consisting of over 25,000 indigenous peoples (Santos, 2011). Xinguanos, natives of the Xingu River Basin, worship the river as the “house of God.” Furthermore, waters from the river are used in ceremonial and symbolic rituals (Santos, 2011). When talking about the cultural impacts of the Belo Monte project, special attention must be given to the profound connection indigenous peoples have with their lands and how this connection contributes to their unique rights of self-determination, property, and culture. Overall, the adverse impacts that result from Belo Monte’s construction are evident and the State’s conduct in carrying on with the project is in violation of national and international law (Jaichand, 2013).

Due to the Belo Monte Dam, 80% of the Xingu river will be diverted through artificial channels to feed the turbines, a 120 km stretch called Volta Grande do Xingu (Xingu’s Big Bend) will suffer severe lack of water (Baptista 2011). Indigenous lands as well as many riparian communities that depend on the river for subsistence, income, and transportation are located along this stretch. The Belo Monte project will displace between 20,000 and 40,000 people, both rural and urban, destroying their livelihoods with little or no compensation. In addition to the hundreds of riverine communities, about 800 people from the Juruna, Xikrin, Arara, Xipaia, Kuruaya, Kayapó, and other indigenous ethnicities in the surrounding region will no longer be able to depend on the river for survival (Diamond, 2016). Receding waters will make it impossible for local communities to travel by boat to sell their produce or buy staples in town. Upstream communities, including the Kayapó, will lose migratory fish species essential to their diet. And for the people who call the river basin home—from the Kayapó of the upper reaches of the Xingu’s tributaries to the Arara, who live alongside its waterways—they will lose their entire livelihoods (Diamond, 2016).

Indigenous groups throughout the Xingu river basin have consistently and adamantly spoken out against government plans to continue with the Belo Monte project. Indigenous leaders have gone as far as to promise to lay down their lives to defend the river upon which they depend for survival (Diamond, 2016). This problem where indigenous voices are not being heard draws from a greater problem: Brazil’s indigenous peoples have ambiguous legal standing. Policies have been passed that address indigenous rights, but few have been successful. Furthermore, this has encouraged persistent discrimination by the non-indigenous community, and has allowed corporate and economic interests to take priority in the development and management of indigenous lands (Bingham, 2010). Moreover, linguistic and geographical barriers, together with unfamiliarity with the political system, have led indigenous Brazilians to depend heavily upon outside mediators to defend their rights, a situation that continues today. This situation creates the perfect conditions for Silva’s foundation to step in.

Environment

Since IBAMA’s 2009 environmental assessment, the communities surrounding the Xingu River have been displaced and are now experiencing a drastic decreased quality in life. Despite the PBA (Basic environmental Assessment Plan) in which project executives agreed to fulfill 117 socio-environmental conditions within the region, locals have faced increased surges from the river, a shortage of fish, and sanitation issues. Many of these environmental concerns can be traced back to IBAMA’s environmental assessment which is now under scrutiny for noncompliance with environmentalists and indigenous populations (International Rivers, 2016).

Prior to the construction of the dam, the river had a steady flow; however, villagers are now reporting random tides. This inconsistent flow is due to miscalculations regarding the holding capacity at one of the reservoirs. As a result, these surges are violent and, because they are unpredictable, children are cautioned away from playing in the river (International Rivers, 2016).

Many justify dams as a being a clean energy source; however, when built in tropical areas dams can give off levels of methane that are comparable to coal fired plants (International Rivers, 2016). High methane emissions are a result of decaying vegetation that is swept away with violent surges. When doing their environmental assessment, IBAMA failed to execute this component of the dam thus leading to 400km² of forest that has been uprooted from these surges (International Rivers, 2016).

Shortly after the dam was constructed, sixteen tons of fish died after the reservoir flooded for the first time. Despite IBAMA's environmental assessment, they failed to include the economic loss in such a large reduction of fish. Rather than taking accountability for their inefficient assessment, IBAMA fined North Electric for the loss in fish. It is unknown if the funds from this fine made it into the hands of the fishing communities; however, it is highly unlikely when reflecting upon Brazil's highly corrupt government.

Not only are communities facing economic distress over the construction of the dam, many are also flooding, and poor sanitation is a result. Gardine Indipendici-1 is a community that has suffered from the diverted river that has caused massive flooding and contamination. Video footage shows sewage backing up and high flooding in housing when the river is diverted. Whirlpools of trash and human waste are now commonly swept through communities and into houses. Many are feeling helpless without the fulfilled promise of an updated hospital in Altamira, which has seen a 50% increase in population since the construction of the dam. People are unable to receive medical treatment as a response to the poor sanitation conditions that have arisen from the dam.

Recommendations

Recommendation 1: Diversification of Renewables

One proposed solution in order to prevent a project such as the Belo Monte Dam from happening again is shifting the support for hydropower to other sources of renewable energies. Solar and biomass are Brazil's top primary alternatives based on the country's geography and access to resources. Due to Brazil's high levels of sunlight, 4.25 to 6.5 sun hours/day, solar energy has great potential in Brazil (Renato, 2017). According to Rodrigo Sawaia, the CEO of Brazilian Association of Photovoltaic Solar Energy (ABSOLAR), "The technical potential of solar photovoltaic energy in Brazil is immense and surprising. It is more than 28,500 GW in large-scale generation and more than 164 GW in residential roofs in the distributed generation, and these are conservative estimates."

If Brazil rallies behind Sawaia's optimism and harvests more solar energy, solar could steal some of hydropower's slice in the renewable energy pie. The country's biggest hurdles with respect to solar power will be the expensive cost and inconsistent availability. Even though the cost of solar energy has substantially decreased over the past decade, centralized and distributed solar power still requires the proper infrastructure, skilled labor, and storage technology, which can be costly. Furthermore, the harsh reality is that solar energy generates less than 0.01% of the

country's electricity demand. Solar energy becomes even more inefficient during cloudy days or non-sunny times. Solar's inconsistent availability poses an energy issue.

Biomass, specifically sugarcane, is also making a lot of headway in Brazil. According to data provided by the *National Electric Energy Agency* (ANEEL), the nation's installed power in sugarcane biomass plants has reached 10 GW. Brazil has over 380 plants of biomass-based sugarcane (Bayar, 2015). One potential issue with respect to sugarcane biomass is that the crop requires vast land plantations which are often hacked out of CO₂-absorbing forests. This poses its own problems in the fight against global warming.

Moreover, the support must shift away from hydropower and towards other renewable energies if Brazil wants to avoid another Belo Monte Hydroelectric dilemma.

Recommendation 2: Community Unity

To address the injustices Belo Monte brings to indigenous groups, people, regardless of identity, need to stick together. Currently, a challenge that activists, like Antonia, are facing is the lack of unity among tribes. Some chiefs have accepted the compensation money and led the way for indigenous rights to be trampled on. Others have simply decided to stay quiet. Therefore, we suggest investment in social capital building among tribes of the Xingu river basin. One way this can be done is through informational meetings. Meetings will be a platform for discussing indigenous legal rights and forming plans of action. A unified front will overall be more effective. The problem with this is human difference. Indigenous groups of the Xingu differ significantly in language and culture. As such, it will be very hard for communication to happen with present language barriers. Finding translators and getting local tribe leaders on board will be crucial.

Recommendation 3: Accountability

With the current Brazilian political climate, activists such as Silva have to make a concerted effort to keep the government and its agencies operating under fair and reasonable laws. With the large rash of corruption scandals, making sure politicians and judges are held accountable for laws passed and permits given will go a long way to protect human rights.

During the proposal and approval stage of Belo Monte, opponents successfully sued the Brazilian government several times in order to have permits revoked and reversed (Perez, 2015). A continuation of this process is crucial in order to make sure that future building is done with full consideration of social and environmental impacts, given the success of this avenue before it is likely to have a noticeable impact and generate results. However with the high levels of corruption in the current government of Brazil, there is a chance that using this as the only avenue to combat future negative projects will not have as much success as a combined approach.

Keeping international attention on the government of Brazil is also an important step in this process. With the recent public impeachment of President Dilma and the nomination of Michel Temer, making sure that he runs the country without corruption will be a big deal. Taking advantage of the media and making sure the world is aware of what is happening in Brazil will act to keep Brazilian politicians in check. Using international pressure to ensure that there is less corruption in government can add some extra potency to other recommended strategies. While this recommendation might not be as direct in solving the conflict, gathering international

attention to human rights crises and keeping the Brazilian government accountable can bring success to future movements.

Recommendation 4: Research

As a means to protect and preserve the environmental aspects of the Xingu River, more thorough environmental assessments must be conducted. Many scientists are now criticizing IBAMA for producing a lackadaisical assessment, which has resulted in thousands of acres of forest to be swept away by the river, causing an increased release of methane into the atmosphere. A proposed solution to this issue would be to hire a third party company to review a preliminary environmental assessment and to consider the economics of situations that pertain to the massive killing of fish. In order to reduce the amount of corruption during this process, third parties should be nonpartisan and indirectly affected by the dam. A challenge with this solution may be costs. Environmental assessments are costly and time-consuming. To address this challenge, activists should consider partnering with national and international nonprofits.

Conclusion

The hydroelectric energy challenge in Brazil has no clear solutions. However, what is clear is that the economic, social, and environmental costs of large hydroelectric projects like Belo Monte are unsustainable.

At this time, Silva is unsure as to the proper allocation of her award funds in order to bring relief to the largest number of people possible. Furthermore, she is going to conduct a careful evaluation of our research to see which of our recommendations is the most tangible and beneficial for her organization and mission goals.

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