

Brazil Construction

Tensions rise over licensing of dams

Why plans to build two new hydroelectric projects in the Amazon basin have led to controversy and legal battles

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Struggling to keep up with fast-paced economic growth, Brazil is harnessing the power of the Amazon with the construction of two dams along its biggest tributary, the Madeira River. But the projects are highly controversial.

Arguably, Brazil's energy needs are diminishing in the face of the economic crisis, but maintaining a dependable electricity supply has become a priority for President Luiz Inácio Lula da Silva's administration after blackouts in the early 2000s.

State studies of Brazil's rivers and basins claim 80,000 megawatts (MW) of hydroelectric power could be harnessed from the Amazon's tributaries.

Hydro is a high-risk business, says Mauricio Tomalsquim, head of the relatively new Brazilian energy research centre, EPE. Investors ask, "Is there really a market for this energy?"

But he also concedes that "the

risk investors face diminishes substantially", because the Brazilian system of tendering for hydropower contracts, where the bidder offering the lowest rate wins the business, guarantees prices and 30-year contracts. Additional costs get passed onto the customer.

This hybrid Brazilian system does not exist anywhere else. Investors are responsible for planning and building projects, and are guaranteed that 70% of the energy they produce is sold at the agreed price. The other 30% can be sold on the open market.

Tomalsquim argues that the auction system has worked: "A huge number of investors have come into the country in the past few years."

The Brazilian government also supports hydro projects through the national development bank, BNDES. In 2007 and 2008, it put up R\$21bn (\$8.8bn) to build 36 dams totalling 15,243MW.

The bank awarded loans of R\$6.1bn to build the Santo Antônio dam on the Madeira in



December, and R\$7.2bn to build the Jirau dam this month.

"It's a source of energy that we should take advantage of," Tomalsquim says. "It's a way to keep the supply clean without high costs."

But this clean energy is not without controversy.

The three-step environmental hydro-licensing process grew out of the US system of environmental impact studies, according to Antônio Cardilli, finance manager for Odebrecht, one of the dam builders.

The two plants being built on the Madeira are partially licensed, but have also been charged with breaking environmental laws in the initial phases of construction.

Odebrecht and five other companies created a consortium, Madeira Energia, which won the bid to build Santo Antônio in December 2007. GDF SUEZ and three others created another consortium, Energia Sustentavel do Brasil, and won the bid to build Jirau in May.

Upon winning, Madeira Energia presented an environmental plan to Ibama, Brazil's environmental agency, to receive an installation licence to begin construction. Ibama's technical experts said the company's environmental plan was insufficient, and a licence should not be given. But despite internal dispute, Ibama issued the licence anyway, which led to uproar, and legal action by the federal prosecutor's

office in the state of Rondônia. After Energia Sustentavel won the Jirau auction, it presented a plan to move the dam 9km downstream from its original planned location. "They changed the rules of the game," explains Heitor Alves Soares, federal prosecutor for Rondônia.

Soares has filed lawsuits and injunctions against both dams. "What we consider fundamen-

“Ibama's technical experts said Madeira Energia's environmental plan was insufficient. Ibama issued the licence anyway

tal in an environmental impact study is the location of the project," he says. Energia Sustentavel won the bid based on a previous licence, which studied a location that was now no longer part of the plan.

Soares' request to annul the results of the auction is still moving through the courts.

Jirau was placed under embargo, but construction was also allowed to start in November by Ibama thanks to a partial licence, says Heitor.

"This doesn't exist in our legislation," says Soares. "This licence does not exist."

Soares filed an injunction to

have the partial licence revoked, which a judge approved. But this was overruled by a higher court.

Ibama is currently evaluating Jirau's new location and should decide whether to approve it by April, according to Energia Sustentavel, despite the fact that legal and illegal construction has been continuing for months.

Ibama fined Energia Sustentavel nearly R\$475,000 earlier this month for deforesting a permanent preservation area, followed by a fine of R\$950,000 the following week for beginning construction of the cofferdam, which can only be done on receipt of an installation licence.

Meanwhile, in December, Madeira Energia was fined R\$8m for killing 11 tonnes of fish. According to Ibama documents, the transfer of fish from the Santo Antônio cofferdam was done without technical supervision and by people with no training. Ibama called Madeira Energia's actions "gross negligence".

"I'm not against the project in itself, but against the way it was done," says Soares.

He is also concerned about the 2,500km transmission line for the two dams — going straight to Cuiabá in Mato Grosso state and to São Paulo — that will be put out for tender this year.

Another little-discussed aspect of the Madeira dams is the accompanying navigable waterways that will be built. The Madeira dams are complementary to the Integration of Regional

Phil Holmes



REMOTE: The location of the two controversial rainforest dams

Christiana Sciaudone

BOLD MOVES: Building work is under way at the Santo Antônio dam site despite ongoing legal attempts to annul its licence



Infrastructure in South America, a series of projects that aims to promote integration across the continent. They will begin to open up the Amazon and its tributaries as a waterway linking the Atlantic and the Pacific.

The dams will help make 4,200km of the Madeira navigable, with the principal freight being soya from Mato Grosso destined for Europe and Japan. Locks on the dams' waterways, which have not yet been licensed but are in the plans, will help ships sail between rivers that are at different land levels.

"The project always had implications that went beyond simple generation of electricity," says Ricardo Marcio Martins Alves, environment manager for Madeira Energia, who is in charge of the Santo Antônio construction.

Two other dams — one on the border of Bolivia and Brazil, and one in Bolivia — will complete the ocean connection, although concerns about repercussions in Bolivia mean that nothing has gone beyond the planning stage there yet due to internal political resistance. The opposition believes that this area of the Amazon, currently one of the best preserved, will be devastated by the plans to create a navigable link between oceans.

But regardless of protest or legal action, many feel that the Madeira dams are almost unstoppable. The only alternative, it seems, would be to build more oil-powered electricity plants.

Swimming against the current to stop the plans

CHRISTIANA SCIAUDONE

Hydroelectricity accounts for 85% of Brazil's energy supply. Not unnaturally, the country considers itself to have the cleanest renewable energy matrix on earth. However, not everyone sees it that way.

"Is hydroelectricity really renewable?" asks Monti Aguirre, Latin American campaigner for International Rivers, a non-profit organisation that fights against destructive dams. "If you look at the social and environmental impacts of these projects, it's hard to say if it's renewable."

Dams are being built throughout South America to address what are seen as urgent energy needs. Every dam will affect the lives of local and indigenous populations — for good or for ill. They will almost certainly harm the region's biodiversity and destroy swathes of pristine forest.

The Belo Monte 11,000MW dam proposed on the Amazon's Xingú river will affect 27 indigenous and local groups. Aguirre says 70,000 people were displaced by the 340MW Colombia Urrá Dam, which began operation in 2000.

Dams "were, are and always will be the preferred form of energy" in Brazil, "until all the rivers are simply dammed to the hilt", says Glenn Switkes of International Rivers. "Brazil is the largest economy in Latin America and it plays an imperialist role in terms of trying to promote the interests of its companies."

Not only is the continent's largest country damming its own Amazonian rivers, it is reaching into Peru, Bolivia and Argentina for hydropower.

"The quantity of projects is staggering," Switkes says. "It's a rush by these companies to build as many dams as they can. The good news is that there is no money for development, aside from BNDES [the government's national development bank]."

Energy consumption has been



MAKING A POINT: An indigenous tribesman speaks during a public protest against the Belo Monte dam in the Amazon last year

sinking and will probably continue to fall, given the economic crisis, Switkes adds.

International Rivers has been following the development of the Santo Antônio and Jirau dams closely.

"The whole world will suffer the consequences of these dams," says Jorge Gustavo Neves Ferreira, director of Instituto Madeiro Vivo, which defends the rights of the river and its people.

"The issue has spread internationally because it's a project that will have enormous impacts on a wide area of the Amazon, and also because there is a lot of international influence involved in terms of financing," Switkes says. "We've worked to keep private banks out of the project."

Yet BNDES is providing a large amount of financing, Switkes says. The bank "is supposed to create jobs, but this is for Brazilian and transnational companies that are destroying the rivers".

Building the dams will not only

have the immediate effects of flooding, moving residents and deforestation, but will attract loggers and cattle and soya farmers — "impacts that go way beyond the relatively clean construction of the dams", Switkes says.

International Rivers and Instituto Madeiro Vivo are working to make sure indigenous populations and locals are fairly compensated, and human rights are adhered to.

Jirau and Santo Antônio will force the relocation of about 1,200 families—many of whom live on and from the river. However, their living standards should improve with new homes, schools and health clinics being built in compensation.

But, according to Ferreira, the river people do not want what the builders see as "better lives", with constant electricity and solid walls. They want to subsist on their water and land.

"Everything here is better," he says, of the place where he grew up.

Action against the dams is moving through the courts, but it is unlikely to halt construction. "We know that Ibama [Brazil's environment agency] has become extremely pliant in terms of the pressures exerted on it by the president and the mining and energy ministry," Switkes says.

"Still, there may come a point when there are enough violations of the conditions that they feel they either need to suspend the projects or they may be subject to a lot more serious litigation."

Repercussions could also flow into other countries.

"One of the fronts on which the project has been criticised is its probable impact on Bolivia," Switkes says. Possible flooding in Brazil's western neighbour could result from sediment build-up at the dams, destroying preserved forest areas and the livelihoods of brazil-nut gatherers and rubber tappers.

"Any interference in the river can change the regime during times of heavy rains," admits Ricardo Marcio Martins Alves, environment manager for Madeira Energia, which is in charge of the Santo Antônio dam construction. "If you're going to dam the river, of course you are going to have an impact."

But Alves says the Bolivian side of the Madeira has been monitored since last year. The use of bulb turbines, through which water flows horizontally rather than vertically, should diminish the build-up of sediment, he says.

Madeira Energia will study the sediment situation before the project is complete and will have time to make necessary adjustments, he says.

Other repercussions include the stagnant waters of the reservoirs, which promote waterborne diseases and malaria, and which act as a haven for predatory fish, eliminating other species that cannot escape.

"There may still be time to save the Madeira," Switkes declares.

Flora, fauna and local people to be relocated

The Santo Antônio dam sits within view of the city of Porto Velho, just 10km away. It is a vital piece of the government's accelerated growth plan and, though it receives no direct funding, it does get tax breaks and other incentives.

Compensatory measures for the population affected by the dam building include not only the relocation of the ribeirinhos — the riverbank dwellers — but also construction of health clinics, anti-malaria pro-

grammes, schools, a triage centre for flora and fauna, and the construction of a beach.

Every bit of flora and fauna will be catalogued, quarantined and triaged, where necessary, so that no species will be lost, says Nelson Caproni, general construction manager of the Madeira Energia, the consortium that is building Santo Antônio.

The fauna is "better treated than the children of the North East [of Brazil, an extremely poor region]", Caproni wryly notes.

The area must be reforested as part of the deal, particularly along the river, where soil erosion is a concern. Deforestation was blamed in part for landslides during the 2008 floods in Santa Catarina state, which killed more than 120 people.

Concerns over the multitude of fish that live in the Madeira have led to the inclusion of two oxygenated fish 'stairs', so they can migrate upstream. Their return downstream is still being studied, says Ricardo Mar-

cio Martins Alves, environment manager for Madeira Energia.

Critics say fish stairs have proved ineffective in other Amazonian dams, although Alves disputes that claim.

However, Alves concedes some species will disappear. "Obviously, the dam is going to have impacts. We have to identify what they are, and which are most relevant, and do what's necessary. We're not going to say that all of them will survive, because that's nonsense."

Brazil Social cost

The end to a way of

The Santo Antônio dam offers the hope of jobs and training for some, yet others are being forced from their homelands against their will

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Neuzete Paulo Afonso is the third generation of her family living by and from the Madeira River. She says no amount of money, and nothing the dam builders can offer, is enough to replace the spirit of her home.

"No good can come of this," Afonso says of the Santo Antônio dam being built 6km from her home in Trataserio, near the city of Porto Velho, capital of Rondônia state.

Afonso, 50, is a *ribeirinho* — a river-dweller.

She fears that the *ribeirinhos'* culture — living simply off of the land and water, making milk out of Brazil nuts, eating the plentiful fish at her doorstep and sharing in the legends of the Amazon — will disappear.

Her grandparents arrived in Porto Velho during the rubber boom in the early 1900s and settled on a patch of land at the edge of the Madeira, where they also worked.

The following 100 years have included a railroad boom, two rubber rushes, a gold rush and an agricultural push. But Porto Velho "still looks like a campground", according to economist Silvio Persivo.

These cycles of boom and bust have left the city of nearly 400,000 in decline, but the hydroelectric-dam builders promise this time can be different.

Some 4.5% of the cost of building the dams will be paid to the city in compensation. Money will come in the form of royalties, taxes and a natural increase in incomes. Porto Velho may also benefit from its position as a major port for soya that is destined for Europe and Japan.

As a result, the city is maintaining 7% growth this year, even though Brazil's growth has slowed to 2%-3% as a result of the economic crisis.

"We're going to jump quickly from a mid-sized to large-sized city," Persivo says.

But already he and others are seeing the repercussions of a lack of infrastructure planning, and worries of chaos and violence abound. Construction is booming, but traffic is bad and costs

are increasing. The city lacks sewerage, and families are pouring from the bus station every day seeking work.

Locals, too, are eager for jobs. Therezinha Gonçalves Pereira got her class-D driver's licence in 1982 so she could drive a school bus, but she never got the job. Now she is part of the Santo Antônio training programme Acreditar (which translates as 'Believe'), learning to drive a truck. Pereira is hoping to get work on the dam building site.

Acreditar was set up by Odebrecht, one of the six companies in charge of Santo Antônio, in part as a response to complaints that dam builders bring in experienced workers and locals get no benefit.

"People come, they exploit, they take the wealth and they leave problems," says Antônio Cardilli, an Odebrecht administrative manager who established the Acreditar scheme. Residents are traumatised, Cardilli says.

Odebrecht has invested R\$12m (\$5m) in Acreditar, which has "graduated" 6,000 people trained in electrical engineering, truck driving and administration. Cardilli expects to school 25,000 locals — of whom 8,000 are women — although only a maximum of 10,000 will be hired on the construction site. "They will stay here," he says of the newly trained population.

The legacy of the dam will be a population of well-qualified



WHERE THE HEART IS:
Neuzete Paulo Afonso, inset, and her family home at the edge of the Madeira River, which will be destroyed by the construction of the Santo Antônio dam

workers. But it begs the question of where they will find work once the dam is done. Votorantim has opened a concrete factory, and Cardilli says he is trying to attract other industries to the area.

"I truly think that Porto Velho will be the São Paulo of the north," says Nelson Caproni, general construction manager of the Madeira Energia consortium. Santo Antônio is his eighth hydro project. "I've never seen a city worsen after building a hydroelectric dam," he says.

Ricardo Marcio Martins Alves, environment manager for Madeira Energia, says he and his team have painstakingly studied the needs and culture of the people who will be affected.

Many are not landowners and have few rights, and do not understand why they have to give up their homes. But Madeira Energia is attempting to compensate them as fully as possible, Alves says, even though the *ribeirinho* settlements are all technically illegal if they are built within 100 metres of the river.

More than 800 families will have to be moved for the construction of the dam. More than 60 have already moved to a newly built village, while others have taken cash payments and moved into Porto Velho.

Those in the training programme are pleased because they see the possibility of jobs, rather than living with no rights in the grey economy.

Francisco da Chaga Silva Costa, 46, brought his wife to the village because she was interested in a steady job. But he was the one who signed up and went through the programme for electricians.

"It was a new experience, for sure," says Costa, who already works as a contract electrician.

"It's a way to learn about the environment, that it's not just

me, but how to value other things around me. We have to learn to be responsible for our planet. Living here [in the Amazon], we have even more responsibility for our planet."

But Afonso, the *ribeirinho*, does not want a job programme. She already has a job with the city as an infirmity technician, and she stays some nights in a room she rents in Porto Velho, a motorised-canoe ride from home in Trataserio.

She just wants her piece of land by the river and a simple life — although she does have a diesel generator so she can occasionally watch soap operas and football matches. She has resigned herself to the fact that a move is inevitable, even though she worries that many illiterate *ribeirinhos* will be lost to drugs and prostitution in the city.

Afonso says she is being denied the recognition of her property as her own. She says her mother owned the 2.4 sq km plot of land upon which her house and about 15 family members' homes sit — but she is struggling to prove ownership to receive the potential compensation.

"Our family is buried here," she adds. "They are not respecting that." Their remains will be washed away when the dam floods the land.



A NEW DAWN? The declining "campground" city of Porto Velho

Christiana Sciaudone

life

Borrowing cash, making it... and giving it away

Energia Sustentavel do Brasil

CHRISTIANA SCIAUDONE

Last week, the federal development bank, BNDES, approved a public loan of R\$7.2bn (\$3.06bn) — about 70% of the total needed to finance construction of the Jirau dam in the Amazon's Madeira River.

The dam is being built 120km from the city of Porto Velho by Energia Sustentavel do Brasil, a consortium of GDF SUEZ (50.1%), Companhia Hidro Elétrica do São Francisco (20%), Eletrosul (20%) and Camargo Correa (9.9%), which will cover the balance of the Jirau bill.

Once the dam is built, annual royalties will be paid — R\$29m to the city of Porto Velho; R\$29m to the state of Rondônia; and R\$15m to the government.

BNDES has called the 3,300-megawatt (MW) dam, which will generate an estimated 12,000 direct and 30,000 indirect jobs, "indispensable" to supplying the country's energy needs. But the dam has been mired in controversy since Energia Sustentavel won the bid last May.

Shortly after winning with a low-price promise of R\$71.37 per megawatt hour, the company proposed to move the dam 9km from its original location. In addition, it wants to add two turbines to the 44 planned, to increase its capacity to 3,450MW.

The move would minimise environmental damage and cost R\$1bn less than the original location, where the banks of the rivers are high and require heavy excavation, explains Antonio Luiz Abreu Jorge, environment and sustainability director of Energia Sustentavel.

The reduction in costs was the company's competitive edge in offering a bid far below expectations — and 21.5% lower than the R\$91 price cap.

According to its 30-year gov-



HOLY WATER: Priest Island on the Madeira River, the preferred location of the proposed Jirau dam

ernment contract, 70% of the energy generated at Jirau will be sold at the winning bid price, and 30% on the free market.

The contract begins in April 2014, but the dam should start producing energy in 2012. Any energy generated before 2014 can also be sold on the free market.

Additionally, the new location will facilitate the movement of sediment, a major concern in the Madeira, Jorge says.

Jirau's reservoir will be 302.6 sq km, of which 150 sq km will be land that is flooded, including Jaci Paraná, a town of 1,800.

Residents will be moved, should they accept, to a new town built closer to the dam. That R\$60m town will temporarily house the engineers and employees of the dam. Residents of Jaci Paraná also have the option of receiving R\$55,000, which they can use to buy a new home.

The residents of Jaci Paraná "live a miserable life", Jorge says,

showing pictures of the wooden structures that make up the small town. "They are living below the poverty line. They want the dam, they want a real change."

The new town will include homes and plots for residents to farm, and 75% of the workers on the dam are to be local, Jorge says. Job qualification and entrepreneurial training programmes will be set up in conjunction with existing government programmes, Energia Sustentavel is also trying to attract industry to the area to support 2,000 jobs after the dam is built, Jorge says.

A house-building factory has already set up shop nearby to construct 1,000 homes needed for the dam workers.

Jorge says the left side of the dam has already been deforested by agriculture and loggers, but Energia Sustentavel could not provide details of exactly how much land will be deforested.

As at the Santo Antônio dam,

Jirau will use bulb turbines, which produce energy based on the horizontal flow of water, rather than on the fall of water. However, Jirau has a fall of 3.9 metres, which should add to the energy produced.

In December, Energia Sustentavel signed a R\$1.95bn contract with Alstom, Voith Siemens and Andritz for 28 turbines. Later, it signed a \$410m contract with Dongfang Electric Corporation for an additional 18 turbines.

Turbines will be turned on two at a time from February 2012, Jorge says. "We will simulate natural conditions," he says. These will range from 5,400 cubic metres to 34,700 cubic metres of water flow.

Preserving biodiversity is a concern, and Energia Sustentavel is collecting flora and fauna to make sure all are accounted for — the company is even stamping metal tags on turtles and tying strings around frogs.

Working 24 hours a day to be ahead of schedule

CHRISTIANA SCIAUDONE

Construction on the Santo Antônio dam on the Amazon's Madeira never stops.

The 24-hour-a-day building frenzy is aimed at finishing the construction as soon as possible. The faster the dam gets built, the sooner it can start making a dent in the R\$12.2bn (\$5.2bn) investment in it.

Nelson Caproni, general construction manager of Madeira Energia — the consortium building the dam — calls this a new strategy.

He helped to survey the Amazon basin in 2001, and was at the first planning presentation to the national

electric energy agency in 2002.

Six years of environmental and technical studies followed before the tender was won by the consortium, which is comprised of Odebrecht, Andrade Gutierrez, Cemig Geração e Transmissão, Furnas Centrais Elétricas, and the Amazônia Energia investment fund of the Santander and Banif banks.

Madeira Energia won the contract with a bid to supply electricity at R\$78.87 (\$33.15) per megawatt hour. The price was considered low at the time, but it is higher than the R\$71.37 price that allowed GDF SUEZ and its consortium to take the second dam, Jirau.

It rains on average 200 days a year in the region, limiting the work that can be done. Soil cannot be excavated during a downpour. But rocks, which are used to make the concrete, can be excavated at any time, and are dynamited daily.

Construction began in August, and turbines should start working in May 2012, six months ahead of the contracted start date. All systems should be active as of June 2015.

The dam will consist of 44 bulb turbines, each with a capacity of 73 megawatts (MW). Energy is generated from the water's natural flow speed, which also lessens the need for an oversized reservoir, Caproni

says. About 32 machines will run at any given time, generating about 2,200MW.

The turbines should also prevent any blockage of sediment, a big concern for the Madeira, one of the world's largest sediment-carrying rivers.

The reservoir will be 270 sq km. Of this, 110 sq km floods naturally with the rainy season, from November to April. Already, 2,500 people are working on the cofferdam on the east side of the river and excavating the other riverbank.

About 9,000 workers will be employed at the peak of construction in 2010–2011, with an estimated 27,000 indirect jobs created as a result.

Neuzete Paulo Afonso/Christiana Sciaudone



Dam facts

Figures relating to the proposed Santo Antônio dam

3,140

Total capacity in megawatts

\$5.1bn

Total investment in the dam

2,500

Length (in km) of transmission line to São Paulo

18m

Amount (in tonnes) of granite to be excavated from the site

300m

Amount (in tonnes) of concrete to be used in construction

813

Number of families displaced