

Jirau, far beyond energy

A story of dreams
and transformation



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To everyone who has contributed — and continues to contribute — to making Jirau Energia a benchmark in sustainable energy generation in the Amazon.

About Jirau Energia

Corporate Profile

The Jirau Hydropower Plant, with an installed capacity of 3,750 MW, is located in Porto Velho, in the state of Rondônia, on the Madeira River. Its operation and maintenance are carried out by Jirau Energia — a Special Purpose Entity (SPE) whose shareholders are ENGIE, holding a 40% stake; Axia Energia, also with 40%; and Mizha, a Mitsui subsidiary, with 20%. The commercial operation of the first generating unit began in September 2013, and the full commissioning of all 50 generating units was completed three years later, in November 2016.

As of January 1, 2023, following the ordinary review of firm energy for centrally dispatched hydropower plants, the amount allocated to Jirau was set at 2,101.5 average MW. Built with optimized engineering, advanced technology, and outstanding social and environmental performance, the hydropower plant is the fourth-largest electricity generator in Brazil in terms of installed

In 2023, Jirau became the first plant in Latin America to receive Gold Certification from the International Hydropower Association (IHA), reaffirming its commitment to sustainability.

capacity. The project is still registered with the Clean Development Mechanism (CDM) of the United Nations (UN), avoiding the emission of 6 million tons of CO equivalent per year.

In addition to its energy relevance, the plant plays an important role in the region, with more than R\$ 1.2 billion invested in social and environmental initiatives and an average annual contribution of R\$ 100 million in financial compensation for the use of water resources. One highlight among these efforts was the development of the district of Nova Mutum Paraná, which was handed over to the administration of the Municipality of Porto Velho in January 2011.

In 2023, Jirau became the first power plant in Latin America to receive the Gold Certification from the International Hydropower Association (IHA), reaffirming its commitment to sustainability.

In 2024, the plant's workforce consisted of 305 direct employees and approximately 900 contracted workers. The energy generated that year supplied around 6 million households, based on an average residential consumption of 174.7 kWh per month, according to data from the 2024 edition of the Electric Energy Statistical Yearbook published by the Energy Research Company (EPE). This volume corresponds to 3.6% of all electricity in operation in the country. In addition to supplying energy to Southeast Brazil through a 600-kV transmission line connecting Porto Velho to Araraquara (SP), the project plays an important role in partially meeting the demand of the states of Acre and Rondônia.

The construction and operation of the plant demonstrate that it is possible to implement responsible infrastructure in the Amazon region, both from an environmental and a social standpoint.

SHAREHOLDERS



VISION

Being the benchmark in sustainable energy generation in the Amazon.

MISSION

To generate renewable energy sustainably, fostering development and enhancing society's well-being.

VALUES

- Ethics
- Trust
- Security and Integrity
- Sense of Ownership
- Commitment

X-RAY OF THE PROJECT

CHARACTERISTICS OF THE PLANT

Jirau was built on the foundation of what is known as optimized engineering, an innovative approach that takes into account environmental stewardship, tariff affordability, and the new technological frontier of turbines and generators, resulting in greater energy security for the country. Its dam consists of a rock-fill embankment on the right bank and a section with an asphalt-core on the left bank.

INSTALLED CAPACITY

Jirau has an installed capacity of 3,750 MW, which represented 3.6% of all hydropower generation in Brazil in 2024. It has two powerhouses: the first, located on the right arm of the Madeira River, with 28 bulb-type generating units integrated into the intake structure; and the second, on the left bank, with another 22 units of the same type, anchored at the southern tip of Padre Island. In total, the plant comprises 50 generating units, each with 75 MW of capacity.

Jirau is the fourth-largest electricity generator in Brazil in terms of installed capacity, behind Itaipu, Belo Monte, and Tucuruí.



NOVA MUTUM PARANÁ

Aligned with its sustainability strategy and commitment to fostering local development, Jirau Energia carried out the urban planning project for Nova Mutum Paraná, which was handed over to the administration of the Municipality of Porto Velho in January 2011. The district comprises 1,600 homes across an area of more than 2 million square meters, with capacity to accommodate up to 6,000 residents.

Located along the BR-364 highway, 120 km from the capital of Rondônia, its infrastructure was designed to meet the needs of the local population: paved streets; elementary and high schools; a daycare center; a health clinic; a District Administrative Center; an Integrated Public Security Unit (Unisp — Military Police, Civil Police, and Environmental Police); mobile phone coverage and 4G internet; basic sanitation; selective waste collection; electricity; leisure areas and landscaping; a recreational club; a commercial center; a bus terminal; a well-structured local retail area; and an open-air market.

Nova Mutum Paraná has 1,600 homes spread across an area of more than 2 million square meters, with capacity to accommodate up to 6,000 residents.



ENVIRONMENT

There are several social and environmental programs that ensure continuous monitoring of wildlife and vegetation within the hydropower plant's area of influence. The company invests in qualitative and quantitative population studies of regional species, with the aim of safeguarding biodiversity and the biotic integrity of local ecosystems. Currently, 630 hectares are undergoing reforestation, an initiative carried out in partnership with small rural producers and family-run nurseries.

During the construction phase, 34 social and environmental programs were implemented, most of them carried out in the area surrounding the plant's reservoir, fostering the participation of the local community in environmental conservation initiatives.



Galbula cyanescens (Arimamba-da-capoeira)

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Proud to belong

**Innovation. Boldness. Resilience. Overcoming.
Dedication. Will. Purpose. Commitment.
Teamwork. Professionalism. Belonging.**

These are the words that capture the defining moments of Jirau's journey, which year after year advances with the firm purpose of being a benchmark in sustainable energy generation in the Amazon — with unconditional respect for the environment, for life, and for everyone's well-being.

From the innovative proposal presented during the concession auction in 2008, through the many challenges of construction, and into the ongoing pursuit of operational excellence, it is the people who have made — and continue to make — Jirau a fundamental project for Brazil's development, delivering clean and renewable energy to more than 40 million Brazilians. And there is still much more to come.

In 2024, we overcame the most severe drought ever recorded on the Madeira River, and in 2025, the third-largest flood — clear evidence of how climate change brings new adversities and reinforces the need for aligned purposes and collective effort so we can continue advancing on this virtuous journey. Aware of the challenges already overcome and the promising future ahead, we are preparing to contribute to many more chapters of this success story.

In 2024, in operational terms, we once again achieved an availability index above 99%, placing us among the best-performing power plants in the country. This result reflects the continuous improvement of maintenance activities and the implementation of

cutting-edge technologies, such as the log-boom system, which has enhanced both the safety and the performance of our operations.

We intend to further increase our efficiency and generation capacity. In 2024, the Memorandum of Understanding signed between Brazil and Bolivia paved the way for Jirau to operate at the 90-meter elevation. Once implemented, this change may lead to greater energy supply, strengthening the energy security of both countries, promoting Latin American energy integration, and generating even more value for society. It is worth noting that this added operational flexibility comes at a time when hydropower is becoming even more relevant within the national electricity system.

When the new sector model, established by Law No. 10,848 of March 2004, was enacted, Brazil's energy matrix was predominantly hydro-based. Twenty-one years later, the expansion of decentralized generation and variable sources such as wind and solar has introduced new complexities to system operations. If in the past the discussion focused solely on energy supply, today it also encompasses attributes such as capacity and flexibility.

In addition, hydropower plants are able to adapt quickly to fluctuations in electricity demand, allowing generation to be increased or reduced within short timeframes, meeting peak-load periods and ensuring the stability of the electrical system. At a time when the system operates with less dispatchable energy, hydropower becomes a strategic asset for the country as it moves toward a balanced energy transition.

Since its inception, Jirau Energia has operated in alignment with a sustainability strategy aimed at generating positive

Certification by the United Nations Clean Development Mechanism (CDM) positions us as the largest renewable energy project in the world.

environmental and social impact. Certification under the United Nations Clean Development Mechanism (CDM) positions us as the largest renewable energy project in the world. Meanwhile, the district of Nova Mutum Paraná—planned to accommodate the families who lived in the project area—has brought a new reality to hundreds of people.

Following Jirau's journey — its progress, operational excellence, and contribution to the country — reinforces the pride of belonging to this project. More than a slogan, this feeling reflects the certainty that each employee is part of something greater: sustainable development in the heart of the Amazon. People make the difference.

Enjoy the reading!



Edson Silva is the Chief Executive Officer of Jirau Energia and a member of ENGIE's Executive Committee in Brazil, having joined the group in 2000.



Mauricio Bähr, Mauricio Bähr, who has been with the group since 1997, is the Chairman of the Board of Directors of Jirau Energia, ENGIE Brasil, and TAG.

Timeline

2001

In January, the Brazilian Electricity Regulatory Agency (Aneel) authorized the consortium formed by Furnas Centrais Elétricas and Construtora Norberto Odebrecht to **begin the inventory studies of the Madeira River**, in the section located entirely within Brazilian territory, covering the Santo Antônio and Jirau hydropower plants.

2002

In November, the **inventory studies are submitted and approved** under Order No. 817, which is then published in December in the *Federal Official Gazette (DOU)*.



2003

In January, the consortium formed by Furnas and Odebrecht requests authorization from Aneel to prepare the **feasibility study** for the Santo Antônio and Jirau hydropower developments.

2004

In March, Law No. 10,848 is enacted, establishing the regulated and free contracting environments, the energy-procurement auctions, and the **Energy Research Company (EPE)**.

Ibama issues the Terms of Reference for the two hydropower developments on the Madeira River (Jirau and Santo Antônio), establishing that they be treated as a single complex and that the environmental studies be carried out jointly, “covering both hydropower plants and the associated transmission system”.

In December, the **first energy-procurement auction** under the new model is held.

2005

In February, the **Kyoto Protocol** came into force, introducing carbon trading and guiding the use of renewable energy sources.

Furnas and Odebrecht submitted the feasibility study for the hydroelectric plants for ANEEL's **technical analysis**.

2006

Ibama approves the Environmental Impact Study (EIA) of the projects of the Madeira River.



2007

On July 9, Ibama issues Preliminary License No. 251/2007 for the **two dams of the Madeira River**.

On July 15, **Energia Sustentável do Brasil** (ESBR, the original name of Jirau Energia) was established as a privately held corporation headquartered in Rio de Janeiro, created to participate in the Santo Antônio auction.

In December, **the auction for the Santo Antônio hydroelectric plant was held**, and it was won by the consortium led by Odebrecht and Furnas.

2008

In May, **the Energia Sustentável do Brasil consortium won the auction for the Jirau Hydroelectric Plant** with an innovative project.

On August 12, **the concession for the use of public assets to exploit the hydraulic energy potential** of the Madeira River, in the state of Rondônia, for the Jirau Hydroelectric Plant, was published in the Official Gazette (*DOU*).

The **installation license for the construction site was issued**.

The agreement with Dongfang for the supply of turbines was signed.



2009

BNDES approved financing of R\$ 7.2 billion for the construction of the plant.

The **Jirau Socio-Environmental Observatory** was implemented, with actions aimed at the participatory construction of the organization and the implementation of the Environmental Education Program.

On June 3, the **Environmental Installation License (LI)** was obtained, marking the beginning of the construction.



2010

On July 30, **electromechanical assembly** began.

On September 25, the **Porto Velho Rural Producers Cooperative** (COOPPROJIRAU) was founded with 27 founding members, all family-farming rural producers.

2011

On January 19, **the district of Nova Mutum Paraná was inaugurated**.

A **fire** hit the facilities intended for the workers and caused losses to the construction.

The diversion of the Madeira River was completed

The construction of the **Nova Mutum Paraná Cultural Center** was completed, the result of actions under the Archaeological, Historical and Cultural Heritage Management Program.

ANEEL approved the project **to expand the plant's capacity to 3,750 MW**.



2012

A **second fire** hit the construction.

On October 19, **Operating License (LO) No. 1,097/2012** was issued.

The plant was evaluated under the **Hydropower Sustainability Assessment Protocol** (HSAP), demonstrating that its socioeconomic and biophysical programs were aligned with international best practices.

The **Fish Passage System** (STP) was implemented.

The first service for the **recovery of a degraded area** was carried out by COOPPROJIRAU.

ENGIE increased its stake in Jirau to 60% by acquiring an additional 9.9% share that previously belonged to Camargo Corrêa.

2013

In May, [the Japanese group Mitsui joined the consortium](#), acquiring 20% of ENGIE's stake.

On September 6, the first Generating Unit 29 entered **commercial operation**.

Jirau was registered at the UN under the **Clean Development Mechanism (CDM)**.

On November 26, the **Madeira Transmission Line** ('Linhão do Madeira') was energized — the longest high-voltage direct current (HVDC) line in the country.



2014

In January, the **Code of Ethics** was launched.

A **historic flood** hit Rondônia.

In June, a partnership was established between COOPPROJIRAU and the **Brazilian Agricultural Research Corporation** (Embrapa).

Twenty-one turbines entered commercial operation, totaling **1,650 MW** of installed capacity.

On December 4, around **200 property deeds** were delivered to the residents of Nova Mutum Paraná.

2015

In July, Provisional Measure No. 688 was published, later converted into Law No. 13,203, which resolved the **impasse over hydrological risk (GSF)** in the regulated market.

COOPPROJIRAU was registered with the [Union and Organization of Brazilian Cooperatives](#) (OCB) in the state of Rondônia.



2016

The Paris Agreement was signed, an international treaty aimed at fighting climate change.

On April 26, the **Cassava Flour Agro-industry** in the district of Demarcação was inaugurated.

In August, Jirau issued its **first batch of carbon credits**, totaling 1.7 million credits.

On November 22, the **full motorization** of the 50 generating units was completed, through ANEEL Dispatch No. 3,032.

[On December 16, Jirau was inaugurated.](#)



2017

A new **hydrological forecasting system** entered into operation, capable of predicting the Madeira River's flow with greater lead time and accuracy.

A commitment was signed with the **Chico Mendes Institute for Biodiversity Conservation** (ICMBio) to support the Jaru Biological Reserve (RO) and the Mapinguari National Park (RO/AM).

The project **Biomarkers of Mercury Toxicity Applied to the Hydropower Sector in the Amazon Region** received the Brazil Environmental Award from the American Chamber of Commerce of Rio de Janeiro, in the Innovation category.

2018

On November 6, the [Science and Technology Center](#) was inaugurated, implemented in partnership with the government of Rondônia.



2019

On August 29, the first renewal of the Operating License (LO) was issued, with a validity of 10 years.

The Açai Agro-industry in Nova Mutum Paraná was inaugurated, with an investment of R\$ 2 million.

[A leadership transition took place at the company: Edson Luiz da Silva took over the presidency, replacing Victor Paranhos.](#)



Jirau was assessed under the Hydropower Climate Resilience Guideline and demonstrated resilience across all five climate-change scenarios defined by the Intergovernmental Panel on Climate Change (IPCC) for its region.

The results of the five hydropower plants evaluated were presented at the World Hydropower Congress in Paris.

2020

On March 11, the World Health Organization (WHO) declares the **COVID-19 pandemic**.

The Socio-Environmental Observatory and COOPROJIRAU sign the **Technical Cooperation Agreement**, formalizing a partnership for the strengthening and sustainable development of the region.

2021

Corporate brand update: ESBR is now called **Jirau Energia**.



2022

Concession extended for 847 days (until December 2045), through Aneel Order No. 921/2022.

Implemented the occupational **health and safety management system**, certified in December by the standard **ISO 45.001:2018**.



Update of **Jirau's Code of Ethics**.

Revision of the **hydropower plants' assured energy**; Jirau now has 2,101.5 average MW, according to Ordinance No. 709/GM/MME, dated December 2.

2023

Jirau becomes the first plant in Latin America to receive the **Gold Certification** of the International Hydropower Association (IHA).



The company rethinks and updates its philosophical foundations, aligning its purpose with organizational changes, cultural transformations in the job market, and movements for diversity, inclusion, and mental health, culminating in a **new mission, vision, and values for the company**.

The **highest operational availability in the plant's history was recorded: 99,97%**.

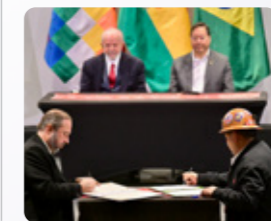
The company **recorded profit for the first time**.

Implementation of the new **Log Boom** project.

In October, the **first engagement survey** is carried out, with 97% participation of employees.

2024

In July, the **Memorandum of Understanding between the Governments of Brazil and Bolivia**, is signed allowing continuous operation at the level 90 meters also during the dry season.



2025

For the fifth consecutive year, Renewable energy from Jirau contributes to the neutralization of greenhouse-gas emissions from the Rio Open, the largest tennis tournament in South America.

In May, EPE publishes the **Technical Note of the Extraordinary Review of the Physical Guarantee** of the Jirau Hydroelectric Power Plant.

1

Auction

At around one o'clock in the afternoon on May 19, 2008, government officials and executives began arriving at the ground floor of the headquarters of the Brazilian Electricity Regulatory Agency (Aneel) in Brasília. The long-awaited auction for the Jirau Hydropower Plant—one of the largest infrastructure projects in Brazil's history, with initial investments estimated at R\$ 9 billion—was about to take place. Security had been reinforced: roughly 100 military police officers were stationed throughout the building, a preventive measure following the protests and vandalism that had occurred months earlier during the auction for the Santo Antônio Hydropower Plant, also on the Madeira River.

Upon entering the building, each person had their name checked against an accreditation list and was directed to a designated area. Journalists were sent to the press room; officials from Aneel and government ministries were taken to a reserved area; and representatives of the consortiums were escorted to exclusive rooms, where they would place their bids with no contact whatsoever with the outside environment until the official conclusion of the auction.

In the investors' rooms, control was strict: laptops, cell phones, and even watches had to be left outside. Only transparent-body pens were allowed. Water, cookies, and sandwiches provided by Aneel were discreetly placed on a few tables. To ensure the integrity of the bidding process, the Federal Police had conducted

1. Throughout its history, ENGIE has gone through several name changes. In 1998, when it made its first investment in Brazil by winning the privatization of Gerasul, the company operated as Tractebel Energia, the Brazilian subsidiary of Tractebel. In 2003, Tractebel merged with Société Générale de Belgique, giving rise to Suez-Tractebel, then a subsidiary of the Suez Group — Created by Ferdinand de Lesseps in 1858 as the Universal Suez Canal Company, the concessionaire responsible for building the canal between 1859 and 1869, and which, in 1997, had merged with Lyonnaise des Eaux to form Suez. In 2008, Suez merged with Gaz de France, creating GDF Suez. In 2016, the conglomerate adopted the name ENGIE.

2. In October 2025, Eletrobras announced its name change to Axia Energia. From that date on, all its subsidiaries — including Eletronorte, Eletrosul, and Chesf — also adopted the Axia Energia brand.

sweeps for bugs and security vulnerabilities both the day before and again just moments before the auction began. Each room was equipped with two computers connected to a dedicated system developed specifically for the event. The bids entered there would be displayed in real time and visible to all participants.

In the bidding process for the Jirau project, two consortia faced off. The favorite was led by Odebrecht Energia and Furnas, repeating the partnership that had won, on December 10, 2007, the auction for the Santo Antônio hydropower plant. At that time, the group secured the concession with a bid of R\$ 78.87 per MWh, representing a 35% discount. The consortium assembled for the Jirau auction also included Construtora Norberto Odebrecht (1%), Andrade Gutierrez Participações (12.4%), Cemig Geração e Transmissão (10%), and the Amazônia Energia II Investment and Participation Fund, formed by Banif and Santander banks (20%).

The rival consortium was led by Suez Energy¹, which entered the Brazilian market in 1998 after winning the privatization auction of Gerasul — the only generation company within the Eletrobras² system to be privatized. **For the group, securing Jirau meant strengthening its presence in a strategic market like Brazil — rich in renewable resources and experiencing strong growth. At a time when the global debate on climate change was gaining momentum, expanding participation in sustainable projects also became an important reputational asset.**

Between 1998 and 2007, the company's installed capacity in Brazil increased by 64%, reaching 6,094 MW, driven by the start of operations at the Machadinho (1,140 MW) and Cana Brava (450 MW) hydropower plants and the acquisition of



Jean-François Cirelli (left), CEO of Gaz de France (GDF), and Gérard Mestrallet (right), CEO of Suez, sealed in September 2007 the global merger between the two companies, creating one of the world's largest energy groups

Suez knew it needed to redesign its strategy — starting with the very structure of the consortium.

Companhia Energética São Salvador, responsible for building the homonymous plant in Tocantins (243 MW). Since 2005, Tractebel Energia — Suez's Brazilian subsidiary — had been listed on B3's Novo Mercado and included in the Corporate Sustainability Index (ISE), strengthening its reputation among investors. The appreciation of its shares and its financial performance followed the same upward trend: in 2007, the company recorded, for the first time, net income exceeding R\$ 1 billion.

Suez's strong performance in Brazil was reinforced by a favorable moment abroad. In early 2008, the company announced its global merger with the French company Gaz de France (GDF), creating the fourth-largest energy group in the world. The new giant combined electricity and natural gas operations, with a strategic focus on global expansion.

The French group intended to lead a consortium with more than 50% ownership and take responsibility for operating the asset. If it won the Jirau project, it would become the largest undertaking in Suez Energy's power portfolio at the time. But achieving that would require thinking outside the box.

The previous experience in the Santo Antônio auction had left important lessons. On that occasion, Suez had submitted the least competitive proposal among the three participating consortia, finishing in third place. The winning bid came from the partnership between Odebrecht and Furnas, while the second-best offer was made by the group formed by Camargo Corrêa Investimentos em Infraestrutura, Chesf, CPFL Energia, and Endesa Brasil.

For the outcome to be different this time, Suez knew it needed to redesign its strategy — starting with the consortium's very structure. In the previous auction, the ownership split limited to Suez (51%) and the state-owned Eletrosul (49%) had proven insufficient. Now, bringing a major construction company into the group would be a key differentiator, especially given the civil-works phase, which was capital-intensive and decisive for the project's competitiveness.

With Andrade Gutierrez already committed to the Odebrecht–Furnas consortium, the viable alternative became negotiating with Camargo Corrêa — a company with a strong track record in major infrastructure projects, including the construction of the Tucuruí plant, the last major hydropower project in the Amazon before the Madeira River complex. Negotiations progressed, and Camargo Corrêa joined the consortium with roughly a 10% stake, accompanied by a clause allowing the sale of that share once construction was underway. Before that, the construction firm had attempted to form an alliance with CPFL, but the utility withdrew from the Jirau dispute, clearing the way for the new Suez-led group. The unsuccessful experience in the Santo Antônio auction left another crucial lesson: the consortium needed to strengthen its financial capacity.

A stronger group, with a larger number of partners, would provide the muscle needed to compete in a large-scale project. However, there were few private players willing to join the venture. Faced with this scenario, the solution was to turn to two state-owned companies from the Eletrobras group (now Axia Energia), which had received the federal government's approval to join consortia and help ensure greater competitiveness in the auctions.

Negotiations were then initiated with Eletrosul — already Suez Energy's partner in the Santo Antônio consortium — and with Chesf, which had been part of the second-place group in that same auction alongside Camargo Corrêa. Both accepted the invitation. Thus, the Energia Sustentável do Brasil consortium was formed, composed of Suez Energy (50.1%), Camargo Corrêa Investimentos em Infraestrutura (9.9%), Eletrosul Centrais Elétricas (20%), and Chesf (20%).

The new consortium, now stronger, combined technical expertise and financial capacity to compete in the Jirau auction. But there was still a significant obstacle to overcome: the strategic advantage accumulated by Odebrecht and Furnas over the years. In the early 2000s, the two companies had been responsible for the inventory studies of the Madeira River power plants, submitted to Aneel in November 2002. Since then, they had also conducted the feasibility studies and the Strategic Environmental Assessment — the latter a complementary analysis to the Environmental Impact Study and Report (EIA/RIMA).

The prior experience and deep knowledge of the region placed Odebrecht and Furnas in a privileged position. In addition, the group had already secured exclusivity contracts with machinery and equipment suppliers established in Brazil.

Para vencer a licitação de maio de 2008, o consórcio Energia Sustentável do Brasil precisava de uma solução criativa e cirúrgica.

This ensured not only faster delivery of turbines and generators, but also a consolidated perception of favoritism in the market — and, to some extent, within the government itself.

To win the May 2008 auction, the Energia Sustentável do Brasil consortium needed a creative and precise solution. The bidding rules allowed for up to three phases. In the first, participants could submit any bid below the ceiling price of R\$ 91/MWh. If the difference between the two best offers was less than 5%, the auction would move to the second phase, in which bids would be generated by computer, and each bidder could choose whether to accept them. If neither party accepted, the auction would proceed to a third stage, where the lowest bid would determine the winner.

Avoiding the move to the second stage was essential for the Energia Sustentável do Brasil consortium, because at that point the competition would become more aggressive and the rate of return would drop sharply. Since Odebrecht and Furnas had won the Santo Antônio auction and could benefit from economies of scale with a second project, they were in a position to submit more competitive bids precisely when the head-to-head dispute would intensify.

Winning right from the start was essential. And for that, there was a trump card. When the Suez Group entered Brazil in 1998 after winning the privatization of Gerasul, it identified an opportunity in the construction and engineering sector: one of its subsidiaries, Coyne et Bellier, decided to invest in the Brazilian market. This move would allow the company to internationalize its operations and take on a significant role in power-generation



Flavio Campos (left), Mauricio Bähr (center) and the general director of Latin America at Suez, Jan Flachet (right): partnership with Leme Engenharia led to success in the bidding.

projects developed by the generator. The company's presence also increased efficiency and offered alternatives to Brazilian construction companies.

In August 1999, Coyne et Bellier opened an office in Brazil, hiring around 50 engineering professionals from Gerasul who had been laid off after privatization. Less than a year later, Coyne et Bellier decided to take an even bolder step: it acquired Leme Engenharia, a traditional consulting firm founded in 1965 in Belo Horizonte, whose portfolio included dozens of clients in Rio de Janeiro, Minas Gerais, and the Northern region.

Since the early 2000s, Leme Engenharia had been identifying potential future hydropower sites for Suez that could be auctioned by the federal government in the following decades. In addition to this mapping, the feasibility of each site was assessed, and the main construction challenges were identified. Based on the reports produced, a database was created in which multiple pieces of information could be compared to support Suez's decision-making process.

This work had another innovation: it allowed the selection of projects based on economic criteria of construction and operation,

One afternoon in early 2008, Flavio Campos, president of Leme Engenharia, called Mauricio Bähr, who led Suez in Brazil: — Mauricio, we've had an idea to put you back in the game.

without interference from construction companies, which had influenced the work of energy firms for decades. Without that influence, the technical work gained relevance, and decision-making about which projects to pursue became deeper and more precise, free from the biased perspective of an interested party that could inflate construction costs. The São Salvador and Estreito plants, in which Suez participated, were the first to receive bids based on the information from the database. From that point on, the relationship of trust continued to grow.

When the Suez Energy executives walked out of the Santo Antônio auction with their heads down, they immediately held a meeting to assess what needed to change. A task force was then created, bringing together Suez's top leadership in Brazil and the technical intelligence of Leme.

The group included, in addition to Leme's staff, Victor Paranhos, Gil Maranhão and Pedro Carelli, strategists responsible for assessing the business's feasibility; environmental engineer and consultant Édio Luz; and geologists Mario Bittencourt and Mario Guedes. The group traveled to analyze the soil and rock formations in the region and even hired a hermit who lived there. They concluded that the site had potential.

One afternoon in early 2008, Flavio Campos, president of Leme Engenharia, called Mauricio Bähr, who led Suez in Brazil :

— "Mauricio, we've had an idea to put you back in the game." Flavio explained, in broad terms, that it was possible to change the location where the dam would be built. The change would make it possible to take advantage of the geology of Padre Island, which would then serve as the foundation for the 8-km dam planned

for the Madeira River. By using the island, it became possible to create two powerhouses, one on each bank, built in parallel, which would speed up the project.

There was more. **Moving the project 9 km downstream would take advantage of the river's width to install the project's main structures directly on the riverbed, significantly reducing the volume of construction work** — something that would not be possible if the plant remained at the Jirau falls. With the plant on Padre Island, there would be an additional flooded area of approximately 10 km², but this increase would be offset by the reduced need for embankments compared with the excavations required at Jirau. Less rock removal and less excavation meant greater savings. The new alternative would allow the plant's cost to be reduced by approximately R\$ 1 billion and would still bring forward the start of commercial turbine operation by about one year. This created an important advantage in the auction, since the early energy could be sold on the free market at higher prices.

Upon hearing the explanation, Mauricio asked Flavio not to share the idea with anyone and to go the next day to Suez's office in Rio de Janeiro to present the solution in detail. Flavio went to the meeting accompanied by two Leme Engenharia executives. From that moment on, the matter was treated as a state secret. Nothing was discussed by email or phone — only in face-to-face meetings.

Dirk Beeuwsaert, who oversaw Suez's international operations, learned about the matter during a meeting in Brasília, when he visited the Ministry of Mines and Energy with Suez's Brazilian team. Gerard Mestrallet, who in the 1990s, as head of Suez's



Aerial view of Pequena Island and Padre Island before the construction of the Jirau Hydroelectric Power Plant.

parent company, had witnessed the group's growth in Brazil, gave the green light during a meeting in Paris, the company's headquarters. **"It was an opportunity to grow with renewable energy and to reconcile expansion with environmental preservation. It was a Herculean undertaking," Mestrallet recalls.**

Fearing that, if the data leaked, the advantage would be lost, the team responsible for the auction took care to prepare two premise books about the project: one, containing the change in the dam's location, circulated in very few hands; the other, without that information, was distributed without restrictions. Fewer than ten people, between Brazil and Europe, knew of the idea's existence, which was explained for the first time to the members of the Energia Sustentável do Brasil consortium just minutes before the auction. ■■■■

Mauricio Bähr and Victor Paranhos had been working together since the mid-1990s at Nacional Energética, a company created by Banco Nacional to invest in the energy sector. When the financial institution collapsed, they were hired to work at Tractebel (the name used by ENGIE in Brazil between 1998 and 2016).

In September 1998, at the height of the Russian crisis, Tractebel was the only company to participate in the privatization auction of Gerasul, marking its entry into Brazil. Since then, the group had been expanding rapidly. It had already acquired several other assets in the electricity sector, consolidating its presence in the market. However, the Jirau auction represented an unprecedented — and unusual — milestone in the trajectory of the two executives leading the consortium. For the first time, they would have to present the proposal for the construction of the plant right there, inside the auction room, directly to the representatives of Eletrosul, Chesf, and Camargo Corrêa, partners in the project.

About 30 minutes before the auction, Mauricio and Victor asked to speak. **Without being allowed to use a computer or a cellphone, Victor explained in broad terms the idea of shifting the dam's axis, the R\$ 1 billion savings in excavation, and the earlier start of commercial generation, which would allow for additional revenue.** The cost reduction also made it possible to submit a more competitive bid, aligned with the principle of tariff moderation — in other words, it was advantageous for investors, for the government, and for consumers. For that reason, they

“It was an opportunity to grow with renewable energy and to reconcile expansion with environmental preservation. It was a Herculean undertaking,” Mestrallet recalls.

argued that the idea would be well received by everyone and represented a creative engineering alternative.

Under the astonished gaze of the partners, Mauricio added that he had two bids in the inside pockets of his suit jacket: one, in the right pocket, based on the assumptions presented by Victor, which would allow them to be competitive and perhaps win the auction; the other, in the left pocket, the alternative that meant doing more of the same — a scenario in which victory would go to the competitors, because the group would hardly reach an attractive price. In the Santo Antônio auction, while the winning bid had been R\$ 78.91 per MWh, the one submitted by Suez had come close to R\$ 100 per MWh.

— “But what about the environmental impact of the change?” asked a shareholder.

— If the plant were built at the Jirau falls, the large volume of still water in the reservoir could lead to two major problems: the growth of algae and the proliferation of mosquitoes. Stagnant water facilitates excessive algae growth, polluting the river. In addition, mosquitoes — including the malaria-carrying species — would have an ideal breeding ground. At the new site, these two problems would practically disappear.

— And will the flooding harm more families?

— Fewer than ten additional families were identified.

This number was small because, in that region, the people living along the banks of the Madeira River would already be affected by the flooding caused by the Santo Antônio Plant. Part of the district would be impacted by the hydroelectric construction works. As compensation, the construction of a new town was planned,

designed to be a model and based on the premise of promoting a new path of development for the Amazon.

Mauricio and Victor showed those present the return rates based on different investment amounts. Meanwhile, attorney Carla Carvalho handed each company representative two contracts: one confirming participation in the auction and the other formalizing withdrawal. Carla, who had only learned about the proposal to shift the dam's axis at that very moment, tried to remain impassive despite her nervousness and concern that some partner might reject the idea, which could create future problems.

— I say it again: this change allows us to be competitive — repeated Mauricio.

“It was a surprise, we had ten minutes to understand all the information and give the go-ahead”, recalls Ronaldo Custódio, present for Eletrosul at that moment. All signed the document confirming their participation. Shortly after two in the afternoon, the Jirau auction opened. It lasted only seven minutes.

With a bid of R\$ 71.40 per MWh — a 21.6% discount compared to the ceiling price of R\$ 91 — the Energia Sustentável do Brasil consortium won the tender. Since its offer was 5% lower than the one submitted by the group led by Odebrecht and Furnas, at R\$ 85.02 per MWh, the auction was decided in the first round, without a dispute between the rivals. **“It was the beginning of a successful partnership, but the decision surprised part of the government,” recalls José Ailton de Lima, who was operations director at Chesf (now Axia Energia) and a board member of Jirau.**

While the victors hugged each other and celebrated the achievement, executives from Odebrecht, Furnas and government

Shortly after two in the afternoon, the Jirau auction opened. It lasted only seven minutes.

Projeto muda lugar da usina de Jirau
Consórcio formado pela Suez, Camargo Corrêa, Eletrosul e Chesf venceu com deságio de 21,5%

Brasil acerta parceria em energia com os vizinhos
Foi o Brasil quem venceu a disputa por um contrato de 25 anos para gerar energia em Jirau, no Rio Madeira, com um preço de R\$ 71,40 por MWh. O vencedor foi o consórcio liderado pela Suez, formado também por Camargo Corrêa, Eletrosul e Chesf. O preço é 21,6% menor que o teto de R\$ 91 por MWh estabelecido no edital. O contrato prevê a construção de uma usina de 1,2 GW e a instalação de uma linha de transmissão de 1,2 mil km.

Energia à francesa
Consórcio liderado por Suez leva usina de Jirau, no Rio Madeira, com deságio de 21%

SAIBA MAIS SOBRE AS CONCESSÕES

Concessionária	Preço (R\$/MWh)	Deságio (%)
Consórcio Energia Sustentável do Brasil	71,40	21,6%
Odebrecht/Furnas	85,02	18,2%
Outros	91,00	0%

Consórcio multinacional baixa preços e leva usina
Hidrelétrica de Jirau, no Rio Madeira, fica com grupo liderado pela Suez

Jirau tem deságio de 21,6%
Consórcio Energia Sustentável do Brasil vence disputa com proposta de R\$ 71,40 por MWh. Adaptação no local da usina economizará US\$ 1 bilhão nos custos e antecipação da geração para início de 2012 deve reduzir preço da energia em 22%

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The bet on changing the dam's axis allowed the winning consortium to offer electricity from Jirau at R\$ 71.40 per MWh, a discount of 21.6%, surpassing favorites. An engineering and strategy case that marked the Brazilian electricity sector and proved the success of the auction model.

representatives looked at each other. The astonishment was also reflected in the faces of the authorities. Discreetly, the government celebrated the result behind the scenes, believing that competition had contributed to tariff moderation, but it was not clear what had guided the decision. “It was surprising and showed that the auction brought benefits,” recalls the then-president of the Energy Research Company (EPE), Mauricio Tolmasquim. “It was an unexpected development for much of the government, a sign that real competition existed, but everyone wanted to know the assumptions behind the winners’ bid,” recalls Veronica Sanchez, now the director-general of the National Water Agency (ANA) and, at that time, part of the Sub-Chief for Coordination and Monitoring at the Ministry of the Civil House of the Presidency of the Republic, one of the coordinating bodies of the Growth Acceleration Program (PAC).

The suspense surrounding the assumptions that had led ESBR to win the auction lasted only a few minutes. Cameramen, authorities, and executives from the losing group rushed to Aneel’s auditorium to follow the press conference. There were not enough seats for everyone. Many sat on the floor. As the participants settled at the table, journalists asked Victor Paranhos, the consortium’s leader, whether he had any brief comment to offer so that a headline could be sent to online news services. **With his imposing voice, Victor spoke loudly so that everyone could hear :**

— Our bid was highly competitive and based on the assumptions of an innovative solution.

What premises? What are they? — asked journalists.

Seated at the main table were the Minister of Mines and Energy,

As soon as the result was announced, journalists, cameramen, authorities and executives of the losing group rushed to the Aneel auditorium to follow the press conference and understand what had happened.

Representatives of the winning consortium, formed by Suez Energy, Eletrosul, Chesf and Camargo Corrêa, after the announcement of the bidding result.



Edison Lobão; Aneel’s director-general, Jerson Kelman; the reporting director for the auction process at the agency, Edvaldo Santana; and the president of the Special Bidding Commission, Hêlvio Guerra, and representatives of the companies that made up the winning consortium. They all heard Victor’s statement and were just as curious as the journalists.

Amid the commotion, Mauricio Bähr asked Kelman whether he could show a video to explain what Victor was referring to.

Kelman consulted Lobão.

— You can put it on — nodded the minister.

The lights in the auditorium were turned off, and the video began to play on the big screen. The computer-generated images

showed the assembly of the power plant, and the narrator’s voice highlighted its location, ‘9 km downstream”.

At the end of the screening, Mauricio Bähr announced, on behalf of the winning consortium, the intention to submit to Aneel and Ibama a proposal to modify the location of the dam’s axis, shifting it downstream. It was the first time that journalists, the competing consortium, and government authorities had heard the idea.

— But is that allowed?” several journalists asked at the same time. Kelman and Minister Lobão responded with caution.

— We will study it,” said Kelman.

Once the press conference ended, an intense behind-the-scenes dispute began to take shape, with its epicenter at the Esplanade of Ministries.

The victory in the auction could barely be celebrated. As soon as the outcome became public and the strategy behind the winning bid was explained, the defeated consortium began working to contest the result. In a statement to the newspaper *Folha de S.Paulo* on May 20, 2008, it said that it had ‘gone to the limit’ in the dispute for the Jirau plant concession and that the project proposed by the winning group ‘is more expensive, more complex, requires a longer transmission line, has less guaranteed energy to be sold, and the plant’s location will require the construction of a worksite, since it will be installed 130 km from Porto Velho (RO)”.

With this argument, an objection to the result of the bidding process was submitted to Aneel, requesting the annulment of the auction, which could open the possibility of a new dispute or the disqualification of the winner. An administrative appeal was filed at the end of that week and was to be reviewed by the regulatory



The revelation of the ‘innovative solution’ caused immediate bewilderment: ‘But is that allowed?’ the journalists asked. While the government adopted a cautious stance, the defeated consortium (Odebrecht and Furnas) launched a legal battle to annul the auction. It was up to Aneel to technically assess whether the change in the dam’s axis complied with the rules of the bidding notice.

agency by July 23, when the auction’s ratification was scheduled.

Responsible for the studies of the two Madeira River hydropower plants, Odebrecht and Furnas had taken victory for granted. Together, the Santo Antônio and Jirau plants were the flagship of the PAC, which brought together the main infrastructure projects of the Lula administration and totaled around R\$ 20 billion in investments.

For Odebrecht, winning the Jirau project was very important, as journalist Malu Gaspar highlights in the book *A organização*. Odebrecht’s bid to win the Santo Antônio Hydroelectric Plant had been R\$ 79 per MWh, a 35.3% discount from the price of R\$ 122 per MWh set in the bidding notice. “To sell at that price and still obtain some return, they would have to bring the completion of the construction forward even more than they had already planned. This was because the bidding rules allowed that, if they managed to put the plant into operation before the date agreed upon in the contract with the federal government—2013—they could sell energy on the free market at higher prices, according to their expectations, until the date when they would begin delivering it to fulfill the contracts established in the auction. They would also need to win the bid for the second Madeira plant, Jirau, and save through synergy,” the journalist explained.

The pressure initially focused on the regulatory agency, responsible for conducting the auction and validating the result. Anticipating the importance of the decision, Jerson Kelman decided to take part in all technical meetings to discuss the legality or illegality of changing the axis of the Jirau plant. The directive was simple: the matter had to be resolved in

a technical and legal manner, and the agency would remain immune to pressure, allowing the technical staff to work freely.

When reviewing the bidding notice, Kelman and the agency's technical staff analyzed that the auction had been conducted without a basic project — something only possible because it was a bidding process for the purchase of energy, not for the construction of a public work. Therefore, in principle, it would be perfectly acceptable for the basic project to adopt a solution different from the one selected as the starting point in the feasibility study, as long as the new arrangement met four structural conditions :

- a. The preservation of water levels in the border region with Bolivia, as established in the feasibility study, and the none interfere with the implementation and operation of the Santo Antônio plant, located downstream from Jirau.
- b. No reduction of the plant's 'assured energy,' set at 1,975 average MW, nor of the installed capacity of 3,300 MW.
- c. No reduction in the spillway capacity.
- d. No worsening of environmental conditions under the judgment of Ibama. ■■■■

The pressure began to gain traction within the Esplanade of Ministries and in Congress.

A few weeks after the auction, on a Sunday, the reporting director for the case at the agency, Edvaldo Santana, was getting ready for his daily 8-km run in Brasília's Parque da Cidade when his cellphone rang. The screen showed a restricted number. It was ten in the morning, and he immediately assumed that some ministry on the other end wanted to talk about the Jirau case. He was right.

Jerson Kelman was traveling abroad on behalf of the agency. The Civil House Ministry was calling a meeting for Tuesday, at the Palácio do Planalto, to hear several sides regarding the legality of the auction. Edvaldo finished his workout by running home, because he needed to prepare a short presentation of only three slides. On Tuesday, at nine in the morning, he went to the meeting. He remained silent while each participant spoke. He was the last to be called.

Before speaking, he handed out printed copies of the presentation to everyone present. He highlighted a slide showing a copy of the auction notice, where the table with the project's technical details appeared. He drew attention to an asterisk indicating that the plant's location could be modified, provided there was no change in installed capacity or in the assured energy. All indications showed that this was the case. President Luiz Inácio Lula da Silva listened to the explanation and requested that, from that point on, the matter remain under Aneel's responsibility — and that only the agency should speak on the issue.

In parallel, the pressure began to gain traction within the Esplanade of Ministries and in Congress. "Mauricio and I attended

around ten meetings with the federal government’s top leadership at that time,’ recalls Antonio Miguel, who was then heading the construction company Camargo Corrêa. Eduardo Sattamini, who had participated in developing the proposal and was at Suez Energy, traded his Rio de Janeiro office for Brasília, where he spent Monday through Thursday talking with deputies and senators to show the advantages of shifting the dam’s axis.

There were threats that the Judiciary could be called upon. Through the press, information circulated that the auction might be legally challenged, which would open the door to a judicial dispute capable of paralyzing one of the federal government’s main construction projects. The Federal Court of Accounts (TCU) had rejected two petitions from members of Congress who questioned the change in the project.

The escalation of positions led the Palácio do Planalto to go to the press. The Chief of Staff, Dilma Rousseff, stated her position to journalist Claudia Safatle, director of the Brasília bureau of Valor Econômico, in an interview on August 4, 2008. ‘We believe it is essential that these projects move forward (Jirau and Santo Antônio). We are strictly following the steps set out in the bidding notices and post-bidding procedures, which include the government’s commitment to help the winners obtain, with the highest possible quality, all the conditions necessary for them to begin construction. Therefore, if a dispute ends up compromising the construction schedule of the hydroelectric plant — crucial for the energy supply starting next decade — and puts the country’s interest at risk, the government will intervene,’ Dilma assured. She also emphasized in the interview that the solution proposed by the winning consortium was a result of the auction model, which sought greater efficiency.

For the government, the innovative solution was aligned with the idea of tariff moderation and with competition among the groups.

“They designed different layouts. That’s the brilliance of the auction, the brilliance of the competition. By opening the bidding, what we want is competition. The bet is that the private sector will discover the best alternative, that companies will always seek the best price, the best solution. I think it will be very important for the country, especially because, from all indications, the project can be brought forward. It may begin generating energy as early as 2011. That’s what the consortia are saying,” Dilma commented.

“The notion prevailed that the auction had brought competitiveness and innovation, and that it made it possible to harness Brazil’s hydroelectric potential, one of the largest in the world,” says Marisete Pereira, who headed the economic advisory office at the Ministry of Mines and Energy (MME) when the Madeira River projects were auctioned.

The then Planning Secretary of the MME, Marcio Zimmermann, recalls that the Ministry viewed the solution presented by the consortium as aligned with the idea of tariff moderation and with the logic that bidders could propose innovative alternatives. ‘This helped change the groups’ reasoning; the auction was successful and contributed to enabling 25 GW of projects in the Amazon over ten years,’ he says.

The legal challenge did not move forward (Aneel and Ibama directors Jerson Kelman and Roberto Messias were, respectively, sued by the Federal Public Prosecutor’s Office for administrative impropriety because of these decisions, but were acquitted). The losing consortium gave up. Aneel’s board ratified the result of the auction. Concession Contract No. 2/2008-MME-UHE JIRAU was signed on August 13, 2008. ■■■■



After nearly two months of intense behind-the-scenes activity, in a meeting attended by then-president Luiz Inácio Lula da Silva, ministers, and executives from the winning consortium, the Jirau concession contract was signed on August 13, 2008.

After securing the Santo Antônio hydroelectric plant, the Odebrecht–Furnas consortium quickly moved to strengthen its position regarding the Jirau auction. It signed exclusivity agreements with traditional capital-goods manufacturers operating in Brazil, such as Alstom and Voith Siemens, for the supply of turbines for the project. In a highly concentrated market, the measure created a significant barrier for competitors.

To get around the restriction, the solution was to pursue an unprecedented and alternative route: partnerships in Asia. The Energia Sustentável do Brasil consortium reached an agreement with the South Korean company Hyosung for the supply of gas-insulated substations, at an estimated cost 50% below the initially projected value. But the boldest move would come with the choice of turbines.

With the traditional manufacturers unavailable, the choice fell on a supplier that was unprecedented both in Brazil and in Suez’s own history in France: the Chinese company Dongfang, which offered bulb-type turbines at prices about 30% lower than those of its competitors. A team led by Mauricio and Victor, accompanied by Suez technicians, traveled to China to visit the company’s headquarters and facilities.

The choice was strategic for both sides. Jirau would be the largest hydroelectric plant in the world to operate exclusively with bulb turbines, and for Dongfang the contract represented a powerful showcase in one of the largest hydroelectric complexes



With the traditional manufacturers unavailable, the choice fell on a supplier that was new to Brazil: the Chinese company Dongfang, which offered bulb-type turbines at prices about 30% lower than those of its competitors.

Because the turbines would be the largest of their kind ever manufactured in the world, the project required technology transfer and the participation of Brazilian and French engineers in their development



on the planet. For the consortium, it was an efficient and economically competitive solution. However, much of the market and the competitors reacted with suspicion, given the technical risks and the lack of local experience with that supplier.

The negotiations with Dongfang stretched on for weeks, with long meetings involving Chinese, Brazilian, and French engineers. Every detail of the turbine design was scrutinized, and doubts persisted — especially regarding the machines' performance under full load. In one of these meetings, the tension reached its limit. Victor Paranhos, who was leading the negotiations for the consortium, was accompanied by legal manager Paula Barcellos. The discussion revolved around the expected performance of the equipment.

The Dongfang representatives insisted there was no reason for alarm. It was then that Victor interrupted the meeting, slammed his hand on the table, and fired back, direct and blunt :

— *If the turbines don't work, f...*

He then stood up and left the room.

The Portuguese swear word made the Chinese representatives look at one another, confused. They wanted to understand what that verb meant. Carla, one of the members of the Brazilian team, visibly embarrassed, tried to soften it in the translation:

— The project will be compromised.

The Chinese insisted: there was no risk. Dongfang was a Chinese state-owned company with extensive experience in manufacturing equipment for power generation, with an annual capacity of more than 30,000 MW in hydraulic, thermal, and nuclear turbines and generators.

Despite the uncertainties, the proposal was technically promising and economically unbeatable. There was even consideration of having Dongfang supply all the turbines, but the final decision was to split the responsibility: the powerhouse on Jirau's left bank would be handled by the Chinese company; the right-bank powerhouse, in turn, would be supplied by a consortium of traditional manufacturers with a presence in Brazil — Andritz, Alstom, and Voith — which, after pressure from the federal government, broke its exclusivity agreement with the Odebrecht–Furnas consortium.



For Dongfang, it was the company's largest export contract. For Breno Carvalho, a life-changing experience. For Marcio Giannotti, the logistics of bringing in the components resembled a military operation

In December 2008, Energia Sustentável do Brasil signed the contract with Dongfang Electric Corporation International and Dongfang Electric Machinery, officially sealing the Chinese company's entry into the Brazilian market. It was the largest export agreement in Dongfang's history up to that point — and the first time bulb-type turbines of that size would be supplied by a Chinese company for an international project. 'This was an obstacle that led to an innovative solution and generated concern in part of the government,' says José Ailton de Lima.

The agreement would also change the course of Brazilian professionals. Among them was Breno Carvalho, a mechanical engineer trained at UnB and born in Goiânia. Because the turbines would be the largest of their kind ever manufactured in the world, the project required technology transfer and the participation of Brazilian and French engineers in their development. **The company opened the opportunity to all mechanical engineers on the Brazilian team, who would have the chance to go to China and follow everything from the design phase to the final manufacturing of the equipment — a professional experience unlike anything they had lived before, technically and culturally transformative.**

The contract with Dongfang officially sealed the Chinese company's entry into the Brazilian market



At 26, Breno saw there a rare opportunity: to travel to China, immerse himself in a technology unprecedented in Brazil, and take part directly in assembling the turbines that would equip one of the largest hydroelectric plants in the world. He joined an international team composed of French engineers from Suez and professionals from other countries, all brought together to learn about the technology of bulb turbines — the largest ever produced — and to prepare for their work on the assembly in Brazil, as well as to train for future stages of operation and maintenance.

The bulb-type turbines, with their horizontal axis, represented an unprecedented challenge in both scale and complexity. Breno also traveled through other Asian countries on technical visits and inspections of similar units already in operation. When he returned to Brazil in 2012, he began taking part in the complex process of assembling the turbines. The experience was so striking that, years later, in 2021, he tattooed on his right calf the drawing of generating unit 29 — the first Dongfang unit installed at the Jirau plant. ■■■



Construction

Building large hydropower plants in the Amazon was seen as a strategic path to expand Brazil's hydropower potential, increase the use of a low-carbon energy source, boost regional development, and at the same time promote environmental preservation through an orderly model of territorial occupation.

With this vision, President Luiz Inácio Lula da Silva authorized the Ministry of Mines and Energy, back in 2003, to deepen studies on the hydropower potential of the region. On the table were three priority projects: the two plants on the Madeira River, in Rondônia, and Belo Monte, on the Xingu River, in Pará. Since the inventory studies of the Madeira River had been initiated by Furnas and Odebrecht at the end of the president's second term Fernando Henrique Cardoso, the project was more advanced and seemed to be the most viable path for a bidding process.

But moving forward also meant facing resistance — both inside and outside the government. Within the Esplanade of Ministries, the main opposition came from the Ministry of the Environment. In civil society, criticism came from environmental organizations, some of them with direct support from foreign NGOs. 'I even saw official documents from other countries stating that this campaign aimed to prevent Brazil from accessing lower-cost energy,' recalls Nelson Hubner, who worked at the Ministry of Mines and Energy between 2003 and 2008, first as chief of staff and later as executive secretary.



Aerial view of the Madeira River and the forest before construction

It was customary to auction projects only after obtaining the preliminary environmental license, reducing risks and making them more attractive to investors. In the case of the Madeira River, however, the projects were at the center of a controversy that was gaining space in the press and dividing opinions within the government and academia.

The criticisms focused on two main points. The first concerned the impacts on migratory fish, especially catfish, whose life cycle involves traveling from the Andean headwaters to regions near the mouth of the Madeira River. The construction of the dams could interrupt this flow and harm fishing, a vital activity for riverside communities.

The second point was technical in nature: the accumulation of sediments on the riverbed. Some warned that, due to the large volume of sediments carried by the Madeira River, the turbines could be overloaded, compromising power generation and making the investment unfeasible within a few years.

These controversies delayed decision-making during Lula's first term. But as he began his second administration, the president decided it was time to act. In April 2007, after a meeting of the Political Council, he publicly vented his frustration about the impasse surrounding two of the country's largest infrastructure projects:

— Now it can't be done because of the catfish. They threw the catfish onto the president's lap. What do I have to do with that?

Faced with the controversy and the perception that the debate could drag on throughout the second term, Lula decided to intervene directly. In May 2007, he called a meeting at the Palácio do Planalto with representatives from the Ministry of Mines and Energy, the Ministry of the Environment, Aneel, and ANA. The objective was clear: to build technical and political consensus to unblock the project.

The MME team brought to the meeting a strategic guest: engineer Sultan Alam, a Pakistani based in France and considered, at the time, the world's leading expert in river sedimentation. Alam began his presentation with a series of detailed slides, illustrating how sediments and floating logs could pose significant challenges to the operation of the hydropower plants, but he emphasized that all of them were technically controllable.

Among the recommendations, he highlighted the need to design specific equipment for collecting floating and submerged

Given the perception that the environmental discussion could drag on throughout the second term, the government convened an interministerial meeting to decide on the Madeira River projects.

material, as well as the construction and operation of a small-scale hydraulic physical model.

This model would make it possible to simulate, adjust, and optimize the river's behavior, including the arrangement of the spillways and the controlled passage of sand and wood.

Slide after slide, Alam reinforced that the issues were serious but manageable. Once his presentation ended, it was time to address another sensitive topic: the Amazonian ichthyofauna, especially the migratory catfish.

It fell to the biologist Philip Fearnside to lead this part. A senior researcher at the National Institute for Amazonian Research (Inpa), a member of the Brazilian Academy of Sciences, and a global reference on environmental impacts in the Amazon, Fearnside was publicly opposed to the construction of hydroelectric plants in the region. Even so, the MME chose to invite him, trusting that he would focus on technical aspects, such as fish-pass systems and continuous monitoring of species.

Right at the opening, Fearnside was direct:

— I am opposed to the construction of hydroelectric plants in the Amazon, just as I would be anywhere else.

Despite his explicit stance, his presentation was constructive. He pointed out that although there were potential impacts, there were technical ways to mitigate damage, especially through rigorous monitoring of the fish life cycle and rapid responses to any changes. 'He made his position clear, but he also showed that, with proper management, it was possible to protect aquatic fauna and move forward. That was fundamental,' recalls Nelson Hubner.



In the meeting, after hearing ministers and specialists — among them Nelson Hubner — President Luiz Inácio Lula da Silva gave the green light for the auctions of the Madeira River power plants.

The change in the dam's axis led to a new discussion about the project's installation license.

After hours of technical discussion, Hubner recalls that, at the end of the presentations, Lula, seated at the head of the table, looked around and asked whether anyone still had doubts and whether the matter could move forward. Silence was the answer.

A short time later, on July 9, 2007, Ibama granted the new preliminary license for the Santo Antônio and Jirau projects, with 33 conditions. Among them were requirements such as the demolition of the cofferdams after construction, to ensure the natural flow of sediments and larvae, and the implementation of continuous environmental monitoring programs, covering the drift of fish eggs and juveniles, sedimentation levels, and mercury methylation, in addition to various social and environmental actions. From that point on, the Madeira plants left the realm of ideas and entered the realm of construction.

This context is essential to understand the next step after Aneel approved the change in the axis of the Jirau dam: obtaining the installation license for a project that, although pursuing the same objective, presented substantial changes compared to what had

originally been auctioned. When the auctions for the Madeira River power plants were held, both Jirau and Santo Antônio had preliminary licenses based on the inventory studies conducted by Furnas and Odebrecht. The proposal from the Energia Sustentável do Brasil consortium, winner of the Jirau auction, changed the location of the dam — which required a new environmental analysis, given the potential impact of this modification.

For the defeated consortium, the price difference that ensured the winning bid would only have been possible thanks to changes not foreseen in the preliminary license granted by Ibama. In their view, this invalidated the auction and required the process to be reopened. The winning consortium's response, however, was to present detailed technical data. The change had been proposed by engineers from Leme Engenharia, who saw in the relocation of the axis an opportunity to reduce impacts and costs.

The original project envisioned that the dam would be built at the Jirau waterfall, where the river is narrower. This configuration required extensive rock excavation, the construction of spoil piles with large volumes of stone, and the clearing of more than 10 km² of Amazon forest. The alternative proposal moved the dam to the region of Padre Island, where the riverbed is wider. This would allow the main structures to be built within the river's natural course, significantly reducing the need for excavation and, therefore, the environmental impact. Geologists who inspected the area found that there were more natural rock outcrops, which also reduced the need to excavate and move rock.

The comparison was striking: in the original configuration, the volume of excavated rock would be enough to fill Maracanã

Stadium 72 times. The required embankment would occupy an area of 13 km². With the change, the impact would be 20 times smaller in terms of forest cleared for spoil piles — around 0.5 km². There were also other environmental gains. At the Jirau waterfall, the reservoir would result in large volumes of still water, an ideal environment for the proliferation of algae and disease-carrying mosquitoes, such as those that transmit malaria. The new configuration minimized these risks. Although it would create an additional flooding area of about 10 km², this would be offset by the elimination of the embanked area, which would no longer be necessary in the alternative design.

The social dimension was also analyzed. The change in the dam's axis would affect fewer than ten additional families, a number considered marginal, since most riverside communities would already be impacted by the Santo Antônio reservoir. In addition, the district of Mutum-Paraná, which would be relocated, would receive a new planned urban center. The resettlement would bring new houses, well-equipped schools, modern health posts, basic sanitation, full urban infrastructure, and support for job and income generation — all at no cost to the affected families.

The change in the axis was therefore not just a technical matter. It became central to the political, legal, and environmental dispute surrounding Jirau, and ultimately consolidated the winning project as more viable and sustainable, both economically and socio-environmentally.

Even with the technical acknowledgment that changing the dam's axis could bring environmental and operational benefits, it became clear, in the first conversations with Ibama, that the definitive license would only be granted in 2009.

With the change in the dam's axis, the district of Mutum-Paraná, which would be relocated, would receive a new planned urban center and full infrastructure, benefiting the affected families.

The volume of reinforced concrete would be enough to build around 40 football stadiums.



But the schedule of the Energia Sustentável do Brasil consortium did not allow for waiting. The goal was to begin construction still in 2008, even in the middle of the Amazon's rainy season — a particularly challenging period for any civil engineering activity. Work needed to start with the construction site, which would have the scale of a small city: a logistical complex with the infrastructure to house, feed, and transport thousands of workers. The project was impressive. Two million cubic meters of reinforced concrete would be used — enough to build around 40 football stadiums. The steel employed would total 7,500 tons, equivalent to the weight of 11 Eiffel Towers.

It was then that the environmental consultant Édio Luz had an idea. Experienced and accustomed to navigating the legal intricacies of environmental licensing, Édio knew Resolution 237 of the National Environmental Council (Conama) well — especially Article 9, which allows for the issuance of specific environmental licenses according to the nature and particularities of the project. The regulation also provided for aligning the licensing process with the stages of planning, implementation, and operation. In other words, there was legal provision for the consortium to request an exclusive license to build the construction site without depending on the full license for the hydroelectric plant as a whole. Édio had already worked with Victor Paranhos on other major projects, such as the Cana Brava and Estreito hydroelectric plants, and knew that the executive liked to repeat a catchphrase whenever seemingly insurmountable obstacles arose:

We have already done what we can. The impossible we always have to seek.

With the Conama resolution in hand, he went to Victor with the proposal

— **Victor, I think we can try this.**

— **Will it work? The executive asked, straight.**

— **You can try. Meanwhile, we continue with the impact studies for the change of the axis.**

— **Go ahead — he replied.**

The strategy worked. In November 2008, Ibama granted a partial installation license, authorizing the start of the construction site and the initial services. Jirau was starting to get off the ground.

The initial phase of the works was divided: the civil construction



The environmental consultant Édio Luz worked so that the consortium could request an exclusive license to build the construction site — without depending on the license for the hydroelectric plant as a whole.



More than 100 km from Porto Velho, the Jirau construction site had a monumental structure to support what was then the largest infrastructure project in the country: from a bank branch to a movie theater, from football fields to air-conditioned dormitories



would be the responsibility of Camargo Corrêa, while the electro-mechanical assembly would be the responsibility of Enesa.

The turbines on the right bank would be supplied by a consortium formed by Alstom, Voith Siemens, Andritz, and Bardella. The machines on the left bank, meanwhile, would come from the Chinese company Dongfang.

The Camargo Corrêa team arrived in the region at the end of 2008, right in the middle of the rainy season. Even under adverse conditions, they began assembling what would become known as the pioneer construction site — a monumental structure designed to support what was then the largest infrastructure project in the country. The expectation was that, at the peak of civil construction, more than 25,000 people would be working on site.

The dormitories reflected the high standard the consortium wanted to set for the project. All rooms were equipped with air conditioning and housed a maximum of eight workers per unit, each with its own private bathroom — a significant improvement compared to other projects in the sector, where bathrooms are usually shared. Women had exclusive dormitories, reinforcing a safer and more inclusive environment.



Reflecting the high standard that the consortium wished to imprint on the project, the living quarters (at the top, on the right bank; below, on the left bank) were air-conditioned and accommodated a maximum of eight workers per unit. In addition, women stayed in exclusive accommodation, reinforcing a safer and more inclusive environment.

BEFORE



AFTER



The evolution of energy infrastructure in the Amazon: from the pioneer construction site to full operation. The images document the construction cycle of the Jirau Hydroelectric Plant (3,750 MW), highlighting the logistical challenge and the transformation of the Madeira River into one of the main generation axes of the National Interconnected System (SIN). In the top photos, the structure of the powerhouse on the left bank. In the middle photos, the powerhouse on the right bank. In the bottom photos, the spillway structure, essential for the plant's safety and operation.



Little by little, the construction site was turning into a true city. Cafeterias, industrial kitchens, leisure areas, a movie theater, a bank branch with a Bradesco agency, a manager, and ATMs became part of the complex. This self-sufficiency was a practical necessity: unlike Santo Antônio, only 7 km from Porto Velho, Jirau was more than 100 km from the capital. It was essential to ensure that everything workers needed was available on site.

The first head of state to visit the project, President Luiz Inácio Lula da Silva was at the plant at two moments during construction: in 2009, shortly after the river diversion, and in 2010.

On March 12, 2009, President Luiz Inácio Lula da Silva became the first head of state to visit the project. The occasion marked an important moment: days earlier, the diversion of the river through the right bank had been completed. The intervention would make it possible to isolate the future powerhouse with 28 turbines, prepare the ground for the construction of the first spillway, and open the way for excavations on the left arm, where another 22 turbines would be installed.

While the pace intensified at the construction site, one question persisted in the corridors of the consortium's environmental department: when would the definitive installation license be issued? The answer required a constant presence in Brasília. The Sustainability Director, Antonio Jorge, and Thais Soares — the first officially hired employee of the company — began visiting Ibama's headquarters almost daily. At a time when digitalization was still incipient, they filed documents, responded to inquiries, and often waited in the reception area just to be seen by the directors. It was a strategy of visibility and persistence. And it worked.

Eight months after the partial license for the construction site, on June 3, 2009, Ibama granted the installation license for the Jirau hydroelectric plant. A few days later came another milestone: the signing of the financing contract with the National Development Bank (BNDES), in the amount of R\$ 7.2 billion — the largest individual credit line ever granted by the bank at that time. The remaining 31.5% would be contributed by the consortium's partners. The operation followed the project finance model, with amortization over up to 20 years and a total term of 25 years, including the grace period. Jirau now stood among the jewels of the PAC.

With financing secured and the definitive license in hand, a new stage began. Concreting of the spillway started — the structure responsible for controlling the reservoir’s water flow during flood seasons. At the same time, preparations advanced for assembling the first turbines, with the arrival of the Stay Rings — steel rings weighing around 14 tons, responsible for sealing the draft tube area and initiating the electromechanical installation.

Alongside the large-scale engineering effort, there was another challenge just as important: training a qualified local workforce. Unlike other major projects in Brazil, the decision was made not to bring in large contingents of workers from other states, a measure that could create social imbalances and increase costs. The plan was to employ 80% of the workforce locally.

To achieve this, partnerships were established with city governments, the state government, Senai, and Sebrae. Professional training courses were offered, with around 200 graduates per month in activities such as masonry, welding, machine operation, and other essential functions. Job openings were announced on local radio stations, reaching workers both in the capital and in the interior of Rondônia. The effort resulted in the creation of 70,000 direct and indirect jobs over the course of the project.

And there was a distinguishing feature: about 10% of the team was made up of women, a significant number for a large-scale construction project. In roles such as welding, they quickly stood out. **‘This was an important legacy the project left that endures to this day: the appreciation of women,’ says Marcelo Thomé da Silva de Almeida, president of the Federation of Industries of the State of Rondônia (Fiero).**

Large-scale engineering was not the only challenge: it was necessary to train a qualified local workforce. Through partnerships, Jirau generated 70,000 direct and indirect jobs, and about 10% of the team was made up of women



The scale of the project impressed even the most experienced professionals. During a visit to the site, Dirk Beeuwsaert, the top executive of Suez’s international division (then the name of ENGIE), was surprised by the intense activity on the construction site, where thousands of people were working under the strong morning sun on the concreting of the powerhouses. Questions arose: how was all that personnel being fed? How did food reach a site more than 100 km from the state capital, deep in the Amazon?

His curiosity led him to the cafeteria, where thousands of people — from executives to laborers — ate together. After lunch, he asked to see the kitchen, and was stunned. More than 300 professionals worked exclusively in food operations: nutritionists, head chefs, pastry chefs, lead cooks, food-safety technicians, and assistants. The menu was diverse and adapted to specific health needs, with lighter options, restricted diets, and a variety that would surprise any visitor.



At the peak of the project, the three cafeterias served more than 40,000 meals per day — breakfast, lunch, dinner, and a late-night meal. Dirk did the math:

In ten days, there are... 400 thousand meals?!

That's right, replied the employee next to him, without hesitation. Dirk Beeuwsaert wanted more than just to be impressed. As the executive responsible for Suez Energy's international division — at that time overseeing 28 GW of projects around the world — he needed concrete data. Every Monday he took part in an alignment meeting with Gérard Mestrallet, then ENGIE's global CEO, and he wanted to bring information that demonstrated not only the grandeur of the project but also its operational complexity. After all, Jirau was the company's largest project on the planet.

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Intrigued by the logistics of supplying food for the workforce, he asked to accompany, before dawn, the movement of the cargo trucks. In just over an hour, he counted more than 100 vehicles unloading food supplies. The daily volume was staggering more than ten tons of protein, two tons of rice, one ton of beans, and 13,000 French rolls served at each breakfast — reaching 100,000 units per day. The supply chain, besides being robust, was strongly integrated into the local economy. Most of the food came from within Rondônia: meat from Cacoal, rice and beans from Ariquemes, vegetables from Porto Velho. The strategy reduced costs, ensured fresher products, and stimulated regional production.

The stock kept at the construction site was enough to feed the entire workforce for 15 days in case any supply issue occurred — a preventive measure, especially necessary in the Amazon region, where access was more delicate.

If the food-supply numbers were striking, the responsibility of assembling the project was just as significant. Bringing in and installing around 6,900 pieces of equipment — with varying weights and dimensions, coming from different parts of Brazil and the world — in the middle of the Amazon required a level of coordination and precision rarely seen. ‘It was a daily war operation,’ summarizes Marcio Giannotti, who arrived at the plant in July 2010 to join the logistics coordination team, led by Bertling Logistics, winner of an international bidding process.

The main support base was Manaus, whose port infrastructure — strengthened by the Free Trade Zone — was already prepared to receive complex cargo, such as electronics and



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auto parts. From there, barges traveled along the Amazon River and then up the Madeira River to Porto Velho. To make this flow possible, more than eight months of studies were carried out, resulting in the development of specialized vessels and an adjustable transfer platform — a ramp capable of adapting to the river’s changing water levels according to the rainy season.

In Porto Velho, the port terminal was upgraded. Mooring points were installed to accommodate barges of up to 600 tons, and a warehouse was built to store climate-sensitive parts, preventing deterioration from humidity and heat. A technical manual with hundreds of pages was developed to detail the characteristics of each item, facilitating the customs clearance process with the Federal Revenue Service.

From the port to the construction site, the equipment was transported on trailers for about 100 km along the BR-364. Some loads required special operations. A stator, for example,



Some loads required special operations. To transport the stator, for example, the highway had to be completely blocked. The maximum speed was 20 km/h, and the route was completed in stages, with scheduled stops to allow local traffic to pass between segments. The movement required escort from the Federal Highway Police and from the motorcycle unit of the Independent Traffic Company of the Military Police of Rondônia, responsible for temporary blockages on both the BR-364 and the local access roads.

weighs 250 tons and measures 10 meters in diameter. To transport it, the highway had to be completely blocked.

The trailer carrying it had 296 tires and, together with the stator, the set reached 498 tons. The maximum speed was 20 km/h, and the route was completed in stages, with scheduled stops to allow local traffic to pass between segments.

The movement required escort from the Federal Highway Police and from the motorcycle unit of the Independent Traffic Company of the Military Police of Rondônia, responsible for temporary blockages on both the BR-364 and the local access roads. It was an almost cinematic scene, repeated frequently: each load required meticulous planning, route maps, soil analysis, and coordinated schedules to minimize the impact on regional mobility.

“In addition to organizing logistics within the Amazon region, the team responsible for Jirau’s supply operations had to stay alert to what was happening on the other side of the world. It wasn’t enough to ensure accessible roads or operating barges. Harsh winters in China could interrupt production. Strikes at ports in South Korea — from where the substation would depart — delayed shipments. Conflicts in the Middle East could temporarily close maritime routes. The operation had global reach — and any external event could shift a fundamental piece of the board.”

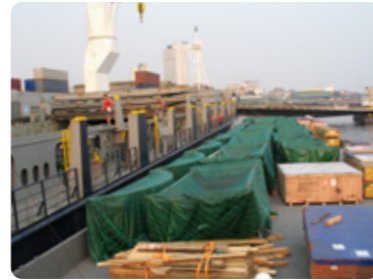
Most of the heavy equipment came from China. Dongfang’s factory was located in the city of Deyang, in Sichuan Province. From there, turbines and components were transported to the port of Shanghai, from where they departed for Manaus on voyages that typically lasted between 37 and 42 days. In

critical situations, the route was completed in just 30 days using faster vessels — a more expensive solution, but one that reduced delivery time.

Building a hydroelectric plant in the heart of the Amazon, right on the equatorial belt, posed challenges beyond logistics: the hot and humid climate. The concreting of the structures, especially the dam, required extreme care. When GDF Suez (then the name of ENGIE) acquired International Power (IP) in 2010, its executives wanted to visit the largest project of the new subsidiary. One of them, Neville Simms, a civil engineer and president of IP, was impressed by the solution found for an old problem in dam engineering in tropical regions.

With average temperatures higher than ideal, the concrete mix could reach thermal peaks capable of compromising its strength, causing irreversible cracking. To control this risk, the construction site was equipped with concrete-cooling units installed in containers, one on each bank of the river. There, flake ice was produced to replace part of the water used in the mix. In addition, chilled water was sprayed over the aggregates, such as crushed stone, through sprinklers — an innovation in the sector. The result: the concrete was poured at temperatures between 15 °C and 17 °C, up to 8 °C below the conventional range.

Productivity was high: conveyor belts connected to trucks poured layers of concrete at great speed, while at the same time requiring strict thermal control. Neville was particularly impressed by the degree of automation and integration of the plants. ‘I have never seen this level of thermal control on such a large scale,’ he remarked at the time.



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In the last week of January 2011, the mechanical assembly of the spillway began. The first piece installed weighed 30 tons. Four synchronized cranes were used to lift it and fit the 180 metal panels that would form the gates of the water-flow structure. Each unit took, on average, 60 days to be completed



The year 2011 began at an accelerated pace. In the last week of January, the mechanical assembly of the spillway began.

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The schedule was steadily advancing toward the second diversion of the Madeira River, planned for July 2011. But an

unexpected event would change everything — something no one on the project could have foreseen, not even with the most sophisticated risk-management systems.

On a stifling March dawn, a large fire hit part of the workers' housing complex. In just a few hours, the blaze would alter the pace of activities, shift priorities, and cast doubt on the future of the project. Jirau's greatest challenge was still to come.

“Shortly after five in the afternoon on Tuesday, March 15, a disagreement between a worker and a bus driver escalated beyond verbal aggression. [...] The bus at the center of the dispute was the first to be set on fire,” reported journalist Fábio Fujita in the May 2011 issue of Piauí magazine.

The fire — investigated by local and federal police, which led to the deployment of the National Security Force — never had its cause clarified. In two days of unrest, the blaze and acts of vandalism left a trail of destruction: 45 buses and 15 cars burned, around 100 housing units damaged, and the loss of movie rooms, game and TV areas, offices, a health post, a bank branch, a snack bar, an internet café, and part of the cafeteria.

As soon as they learned of the severity of the incident, Victor Paranhos and Mauricio Bähr chartered a jet and flew to the site. In a meeting with the construction consortium, led by Camargo Corrêa, they decided that, given the destruction of the housing facilities and the more than 100-kilometer distance to Porto Velho, the solution would be a partial demobilization. With food, leisure, and housing compromised, the stay of thousands of workers had become unfeasible.



The fire led to one of the largest workforce demobilization operations ever carried out in a Brazilian construction project

Once the demobilization was authorized, one of the largest logistical operations in the history of the sector began: around 10,000 workers were sent back to their hometowns, many of them from other states. Between Thursday, March 17, and Sunday, March 20, 2011, 12 Camargo Corrêa executives conducted, nonstop, the negotiations and execution of the evacuation.

The task force relied on a Sesi gymnasium, a sports club, and even a concert venue in Porto Velho, all of which were improvised to accommodate the workers. An events company was hired to provide food and water. A toll-free hotline was also created, receiving more than 15,000 calls from family members. In total, 300 buses and eight airplanes were hired. Since there were not enough vehicles in the capital and many local business owners feared new acts of vandalism, the solution was to rent buses in Brasília, Goiânia, and

The swift and organized response to the crisis prevented the worst: there were no fatalities, and neither the governments nor the financiers' institutional confidence was lost.

Cuiabá. The flights were chartered mainly with Gol and supported by TAM, the Brazilian Air Force, and White Jet. 'It was a war-like operation, days without sleep so that this mobilization could take place and people could leave the area safely,' said Antonio Miguel Marques, president of the construction company Camargo Corrêa.

With the site evacuated, executives from the consortium, suppliers, and construction companies began assessing how and when it would be possible to resume the project. The insurer had begun calculating the losses, while dialogue with BNDES — responsible for the credit line — was immediately reinforced. 'We had an even closer relationship, and at that moment it became clear how important it is to have solid shareholders in a consortium,' recalls Carla Primavera, who took part in structuring the financing.

What could have been the collapse of a megaproject became, in fact, a turning point. The swift and organized response to the crisis prevented the worst: there were no fatalities, and neither the government's nor the financiers' institutional confidence was lost. And although deeply shaken, the project was not halted. Victor Paranhos and Mauricio Bähr met with labor unions, representatives of the Ministry of Labor, and the Office of the President's Chief of Staff. The message was clear: rebuild, resume, pacify.

Still in April 2011, the site had begun to be partially rebuilt. Camargo Corrêa resettled the first workers in temporary modules, while permanent housing units were being reconstructed. Food began to be provided by mobile kitchens. Every detail was redesigned under a new perspective: more dialogue, more safety, more care. What had once been 'just' the country's largest energy project was now becoming a symbol of resilience and reconstruction.



The resumption of the work led to the adoption of temporary modules and mobile kitchens.

Resuming work required understanding the extent of the damage caused by the fire. To build the plant and its two powerhouses — each located on one bank of the Madeira River — two large camps had been erected. The one on the left bank suffered virtually no damage. The one on the right bank, however, had about 80% of its housing units destroyed. The estimate was that work could resume in approximately two months. As soon as the insurance assessment was completed, the strategy would be to call the workers back and gradually restart activities.

Leme Engenharia, present since the project's conception, monitored the planning and schedule with a team of around 150 people. A project of that magnitude required precision and constant supervision. To bring one of the powerhouses into operation, it was necessary to complete more than 35,000 activities, ranging from the most critical to the simplest, such as tightening a bolt or finishing the structure that would support a turbine. A specialized software system supported the control of all stages, helping identify errors and correct them.

Since the work front on the left bank was practically intact, the decision was made to replan the plant, with Generating Unit 29 designated as the first to enter operation.

Since the work front on the left bank was practically intact, it was decided — together with the engineering team, Leme, and the construction company — to replan the plant so that generation would begin on that side, with Generating Unit 29 as the first to enter operation. The schedule was reinforced, since the so-called hybrid stage — which combines civil construction and electromechanical assembly — would become far more intense than initially planned. Assembly, equipment testing, civil construction, and commissioning were all happening simultaneously. Anyone visiting the site would come across technicians from six different companies, each wearing its own uniform.

If the technical front had already been restored, there was another aspect even more important: the human one. An infrastructure project is made of concrete, steel, and machines — but it is sustained by people who dedicate themselves to it. Professionals who lose nights of sleep, who prioritize work often at the expense of their personal lives. The fire was a cold shower for the thousands of workers and executives who had been committed to the project.

“It was a blow,” recalls Paulo Mantuano, the consortium's financial director, his eyes welling up. Paula Barcellos, who was part of the legal team at the time of the accident, relives the pain: “I was hired at the end of 2008, when the first contracts began to arrive.

I would rock my newborn son, Pedro, to sleep while reciting contractual clauses. When we heard about the fire, I cried. Just as I am now, in this interview.”

Recovering morale and confidence was essential. Victor

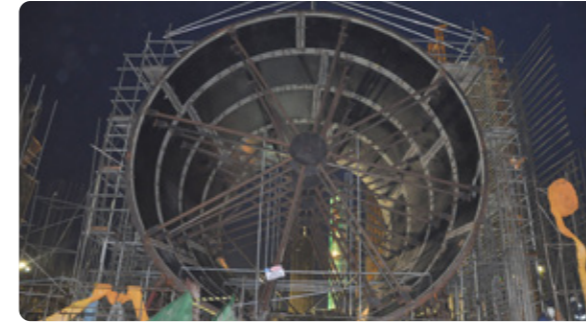


Assembly, equipment testing, civil construction, and commissioning were taking place simultaneously. Anyone visiting the site would come across technicians from several companies, each wearing different uniforms.

Paranhos did not change his routine. He arrived at the site at six-thirty in the morning and walked tirelessly from one side to the other until close to midnight, going up and down stairs, talking to workers, engineers, and supervisors. He wanted to understand, to follow everything closely, to show that the project would continue. Whenever he sensed discouragement, he gathered people and said:

— You will be proud to have built Jirau! You will beat your chests and say you can do anything! We will not stop! We will prevail, we will divert the river, we will deliver the fourth-largest hydroelectric plant in the country!

Paulo Mantuano turns to football to describe the moment: ‘It’s like a coach who sees his team take a heavy blow in the



As construction progressed, moving forward with the electromechanical assembly and the commissioning of the turbines became even more important.

first half. During halftime, he can either give up along with the team, or lift their spirits, strengthen the bonds, and turn the game around.”

The turnaround came less than two months later, when the site returned to activity. On April 11, 2011, part of the roughly 20,000 workers returned. With authorization from the Labor Court, the restart took place gradually, prioritizing those who lived in Porto Velho, Nova Mutum, and Jaci-Paraná, towns near the project.

With the resumption of activities, the focus shifted to completing the river diversion by the end of September, an essential step for advancing the electromechanical assembly and the commissioning of the turbines. The fire, however, put an end to an important ambition: anticipating the start of generation to 2012, which would have allowed the sale of energy on the free market and generated additional revenue early in the operation. The energy sold in the 2008 auction had been set at R\$ 71.40 per MWh for 70% of the plant’s capacity. Producing ahead of schedule and selling the surplus at higher prices would have significantly increased the project’s cash flow. But that now depended on meeting the post-crisis schedule. ■■■■

The diversion of the river is a decisive milestone in the construction of a hydroelectric plant. It can only be carried out during the dry season, when the water flow is lower — a narrow and vital window.

In the case of the Madeira River, this limitation was even more critical: its flow ranged from about 5,000 cubic meters per second during the dry season to more than 40,000 cubic meters per second at the peak of the floods, generating a powerful current that made any attempt to build dams during the rainy season unfeasible.

Missing that window would mean delaying progress by at least a year, until the next dry season. The risk was high — and well known. In April 2009, the technical team had completed the first partial diversion, with the construction of temporary cofferdams that redirected the flow to allow work on the spillway between one of the banks and Padre Island. This initial move made it possible to excavate the foundation of the dam and begin implementing the first powerhouse, where the turbines — the heart of the plant — would be installed.

Now, in 2011, the undertaking was even greater: to carry out the full diversion of the Madeira River, a crucial step for the waters to begin flowing in a controlled manner through the permanent spillway — the structure responsible for regulating the reservoir level and ensuring operational safety. This was the engineering team's main mission that year.

With the full diversion completed, it would be possible to

Aerial view of the installation of the first powerhouse and the beginning of the diversion of the Madeira River.



finish the two powerhouses, install the turbines, and commission the generating units. And, more importantly, to keep the project's overall schedule on track. The plan was to bring commercial generation forward to January 2013. If the diversion was not carried out that year, the deadlines would become unattainable, putting at risk the delivery of the contracted energy — and, with it, the financial and institutional sustainability of the project.

To carry out this second stage, the temporary cofferdams — which had previously been built to temporarily block the flow — were removed, allowing water to begin passing through the spillway openings. But now there was a race against time: the unexpected two-month shutdown caused by the fire had shortened the operational margin. The full diversion was scheduled for July, within the dry season, which would also allow compliance with a legal requirement: it had to occur within 27 months after the issuance of the definitive environmental installation license, that is, by the end of September. Delaying would mean



Removal of the
cofferdams and the
beginning of the
water flow

requesting an extension — a long and uncertain bureaucratic process, with the risk of pushing the decision into the rainy season, when the river’s force made any diversion operation unfeasible.

This would be the worst-case scenario: a one-year delay in the schedule, with a double impact on the project’s cash flow — higher costs to keep the construction site running and a postponement in the start of revenue generation.

The full diversion was also a prerequisite for requesting the plant’s operating license, which would finally allow the start of energy production. But the challenge was technical and colossal. Even during the dry season, the Madeira has a higher flow than most Brazilian rivers. The strength of the current required heavy interventions: drilling large rock formations with high-capacity



equipment, anchoring stone blocks attached to chains to keep them on the riverbed and thus help channel the flow. Everything had to work with millimetric precision.

There was yet another obstacle. To make the river diversion feasible, it was necessary to excavate an access channel to the spillway along a stretch of about 1.5 km, in an upstream area formed by silt deposits (rock powder) that had accumulated during the dry season and prevented the redirection of the waters within the timeframe established in the contract. The initial solution presented involved deploying a high-capacity dredger and earthmoving equipment such as tractors, loaders, and heavy trucks — a technically correct approach for a conventional cut-and-haul earthmoving operation.

However, the nature of the silt to be excavated created an unexpected difficulty. Because it was poorly cohesive and saturated underground, the energy used for excavation was transmitted downward, causing the material to lose even more consistency and no longer provide support for the operation of conventional equipment. Without a firm base, the engineering solution was to create a ‘lining’ of clay and gravel. Even so, stability problems persisted, and the entire process advanced slower than expected.

It was then that Édio Luz, observing the work and reflecting on the impasse, remembered a class from his undergraduate studies in Engineering at the Federal University of Santa Catarina (UFSC). The course was Highways. The professor explained the use of the Casagrande test, a method that determines the liquid limit of a soil — that is, the lowest moisture content at which a sample begins to behave like a fluid. This knowledge, applied to soil assessments for foundations and dams, could be the key to understanding the behavior of the silt and redesigning the excavation approach.

The critical issue was the low cohesion of the silt for the activity to be carried out. But Édio realized that if water were pumped upstream of the planned channel, the return of that flow to the river could promote the hydraulic removal of the accumulated material — precisely what was preventing progress on the diversion. The work could be simplified by the hydraulic transport of the discrete silt particles along the 1,500-meter length of the planned channel. With this hypothesis, he took the idea to Victor Paranhos, who authorized a test on the dam’s plinth.

Using four 100-HP submersible pumps and 1,500 meters of quick-coupling pipe, a system was assembled capable of



At the celebration event, Victor Paranhos announced that the plant could be expanded with the installation of six additional turbines

hydraulically removing the silt. In one week, 500 meters of the material were cleared. In the following two weeks, the entire stretch was completed.

The solution that had been developed would later receive an award in an innovation competition promoted by Suez, with a prize of US\$ 60,000, in addition to the publication of a scientific paper on the method.

All the effort paid off. ‘It was desperate; if WhatsApp had existed back then, I think the anxiety would have been even greater. It was almost at the last minute,’ recalls Maciel Paiva, Engineering Director at Jirau Energia at the time. On September 27, to celebrate the achievement, a party was held on the spillway structure, with fireworks. On the following day, September



The acting Minister of Mines and Energy, Márcio Zimmermann, visited Jirau to celebrate the full diversion of the river



28, 2011, the acting Minister of Mines and Energy, Márcio Zimmermann, was at Jirau to take part in the ceremony, which also became an opportunity for Victor Paranhos to announce that the plant could be expanded with the installation of six additional turbines. The expansion would add another 450 MW to the initially planned 3,300 MW, raising the hydropower plant's installed capacity to 3,750 MW — a proposal that would be approved by the government months later.

The good news, however, came with a downside. Although the river diversion had prevented an even greater delay, the schedules had to be completely redone. The goal established in 2010 — to place the first turbine into operation in March 2012 and have all of them running by November of that year — had become unattainable. The impact of the March 2011 fire was compounded by delays that had occurred at the beginning of the project's civil construction. Between late 2008 and 2009, the work had been halted at different times for a total of 45 days due to lawsuits filed by the Public Prosecutor's Office and delays in the issuance of the installation license. And more unforeseen events were still to come. ■■■■

3

Resilience

In the early hours of Tuesday, April 3, 2012, almost a year after the first fire, a new episode of violence marked the construction of the Jirau Hydroelectric Plant.

A group set fire to dormitories located on the right bank of the construction site, destroying a large part of the facilities. According to Rondônia’s Secretary of Public Security, Defense and Citizenship, Marcelo Nascimento Bessa, 11 people were arrested on suspicion of participating in the attack. The incident occurred one day after the end of a strike that had begun in March, which had halted activities for almost a month and led the government to keep the National Security Force on standby.

The newspaper O Globo, in its April 3, 2012 edition, reported:

“The fire began at around 1 a.m., but the circumstances and motives behind the destruction have not yet been clarified. It is believed that the workers first set fire to the mattresses in the dormitories, which were completely destroyed. According to the construction company Camargo Corrêa, the work has been halted and 3,000 of the 7,000 workers are being taken to the capital, Porto Velho, about 120 km from the plant, due to the lack of housing facilities. The company — which described the incident as ‘new acts of vandalism’ — has not yet assessed the material losses caused by the fire.”

In total, 36 dormitories at the construction site were set on fire. Folha de S.Paulo reported that the state Secretary of Public Security, Marcelo Bessa, requested that the Ministry of Justice send an additional 120 members of the National Public Security

Incêndio destrói alojamento e para obra da usina de Jirau

Cerca de 3.000 funcionários são retirados da área, um morre de infarto



New fire brought unforeseen costs and delays to the construction.

Force. ‘The federal government has confirmed that it will reinforce the deployment of the troops,’ the newspaper highlighted.

The work was partially resumed in just three days, but the fire generated new unforeseen costs. ‘In May 2013, the construction company Camargo Corrêa sent a letter to the consortium that controls Jirau requesting the economic and financial rebalance of the construction contract. At the same time, the São Paulo-based contractor stated that it would not complete the works of the second phase of the powerhouse on the plant’s left bank, where half of Jirau’s 50 turbines are to be installed,’ reported the newspaper *Valor Econômico*, which also noted that the company would continue only with the structural works on the right bank.

Still in 2012, Camargo Corrêa officially left the consortium by selling its 10% stake to ENGIE, which then came to hold 60% of the partnership. Later, in a process conducted by BTG Pactual that attracted interest from Chinese groups and from Japan’s Mitsui, ENGIE sold 20% of its share to Mitsui, in a move considered strategic by the Japanese company.

Koichi Katayama, a board member of Jirau Energia and Mitsui’s representative in the project, explains: ‘Although Jirau was Mitsui’s first electric power generation project in Brazil, the company had invested in several energy-sector businesses in the country, including, among others, natural gas distribution, natural gas cogeneration, refinery and gas-separation projects for Petrobras, as well as FPSOs and drillships for oil and gas exploration and production. The strategic partnership with ENGIE further strengthened Mitsui’s presence and ambitions in the Brazilian energy sector. Mitsui decided to invest in Jirau for

several strategic reasons. Brazil, with its vast natural resources and growing energy demand, offered significant opportunities for sustainable power-generation projects. Mitsui saw the Jirau project as a way to strengthen its renewable-energy portfolio in the Latin American market.”

In 2012, Mitsui became a shareholder of Jirau Energia with a 20% stake.

With Camargo Corrêa’s departure, it became necessary to reorganize key contracts for the operation of the construction site. With Mitsui already among the shareholders, in the second half of 2013 a contract was signed with the Paraná-based construction company J. Malucelli to resume the construction of a powerhouse on the right bank. Another important change was the replacement of the company managing the cafeteria, responsible for serving thousands of meals every day. After a bidding process, the Food Solutions Group (GRSA) was hired. ‘Food service had always been a sensitive point in the execution of the project, which caused some concern, but we were able to adjust quickly,’ recalls Paulo Mantuano.

After the two fire incidents, construction at the Jirau hydro-power plant accelerated. The goal was clear: to place the first generating unit into operation as soon as possible and begin the project’s cash inflow — an objective that had gained symbolic weight in light of the recent incidents. However, the assembly of the equipment was taking longer than expected, partly because the fire had profoundly altered the dynamics of the construction.

The original strategy called for the equipment to arrive at the construction site and be assembled almost immediately, in an optimized sequence. With the work stoppages and the subsequent remobilization of the workforce — a process that took

months — logistics were compromised. Machines of various sizes and levels of complexity remained idle, waiting for the appropriate moment for installation. In a region with a humid climate such as the Amazon, this posed a risk: prolonged exposure could damage sensitive electronic systems.

The solution adopted, once again, was unprecedented.

Warehouses were built to protect the equipment, and Leme Engenharia hired a specialized company to relabel and catalog the items using barcodes, ensuring control and traceability. ‘Even so, the work was challenging. Sometimes, to access one component, it was necessary to move another, even larger one, that was in front of it,’ recalls Flavio Campos, president of Leme Engenharia. The result was a slower construction pace, with the civil works and electromechanical assembly progressing in an even more parallel and interdependent manner.

In November 2011, Isac Teixeira took over as Operations Director of Jirau after winning an internal selection process among the consortium’s shareholder companies. His mission was to assemble the team responsible for operating the plant — a team that would initially work during the assembly phase and later conduct all operations throughout the concession period. The task included attracting experienced professionals and developing new talent. To train younger workers, he established partnerships with SENAI in Porto Velho and Rio Branco, qualifying more than 70 local technicians. Isac also recruited senior technicians from some of the country’s largest power-generation companies. To build the intermediate technical staff, he relied on support from Tractebel Energia (ENGIE’s Brazilian power-generation subsidiary),



A partnership with SENAI was one of director Isac Teixeira's strategies (above, second from left) to train the team responsible for operating the plant. The event marking the agreement was attended by the director of institutional relations, José Lúcio de Arruda Gomes (right), in memoriam

which structured a training program for 40 professionals. “This initiative was a way to contribute to the training of employees and to transfer part of the expertise we had acquired over years of operating several hydropower projects in Brazil to Jirau,” says Manoel Zaroni, who served as president of Tractebel Energia for 17 years.

With the team in the field, one of the priorities was to monitor the construction of the control building, where the systems responsible for monitoring and operating each of the turbines would be installed — a complex set of Brazilian and Chinese equipment. Without this building completed and fully functional, it would not be possible to start up any machine. It was the brain of the plant.

The consortium's president, Victor Paranhos, gave a clear directive:

— Keep a close watch so nothing falls behind schedule.

And, at each meeting, the routine questions became a mantra:

— How is the building coming along? And when will the first unit start operating?

In September 2013, the answer began to take shape. Bringing a turbine into operation is nothing like flipping a switch or starting a car. It is a complex and rigorous process, like assembling a

One of the tensest moments during the equipment assembly occurred during the testing of the gas-insulated substation located in the powerhouse on the left bank, near turbine number 29, the first to enter commercial operation

puzzle with thousands of pieces: all systems must be in perfect compliance — the substation ready, the tests validated, every component functioning with precision. It is the apex of a technical effort that consumes thousands of work hours and mobilizes hundreds of professionals.

In the final stretch, the atmosphere was tense. The Jirau team had closely followed the difficulties faced by the Santo Antônio plant. There, a problem with the turbine bearing had compromised the synchronization of the first unit, causing months of delay. At Jirau, avoiding any similar setback was an absolute priority, especially after the recent history of work stoppages.

One of the most tense moments during the assembly of the equipment occurred during the testing of the gas-insulated substation located in the powerhouse on the left bank, near turbine number 29 — the first to enter commercial operation. Designed to operate at a voltage of 550,000 volts, it had to undergo an overvoltage test of 600,000 volts. Because it was an extremely sensitive environment, the technical recommendation was to keep the area absolutely free of dust or impurities, as any contamination could compromise the performance of the equipment and the safety of the procedure.

The challenge: the commissioning coincided with the final phase of electromechanical assembly and civil works. The construction site was therefore a dusty and busy environment, which required a meticulous task force. Technical teams worked side by side, cleaning every tube and component of the substation, manually wrapping each section to prevent any accumulation of dust. It was an almost handcrafted effort.

After the first test came the second. Before synchronizing the turbine, however, one last and decisive trial remained: the mechanical overspeed test. It consisted of making the machine — a colossus ten meters in diameter — spin 50% above its normal operating speed of 85.17 rpm, with gradual increases of 10% at a time. The goal was to simulate extreme conditions and verify how the structure behaved under stress.

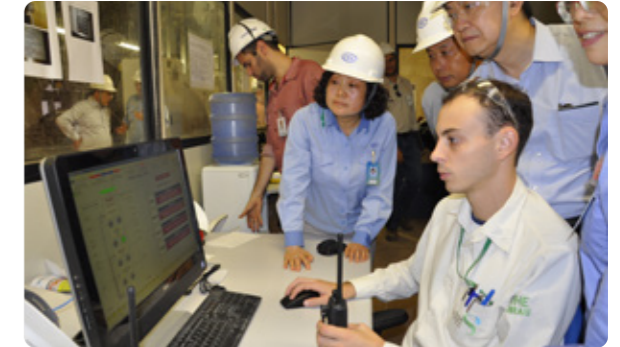
Even under normal operation, the noise of the generating unit was already intense. With the increase in rotation, the sound grew in the same proportion, accompanied by vibrations throughout the powerhouse structure. Jirau, after all, was the hydroelectric plant equipped with the largest bulb turbines in the world — and this was an unprecedented test for Brazilian and Chinese engineers and, to a large extent, for the engineering world itself.

At first, with the rotation at 110% of the nominal speed, the initial noises and tremors surprised the technicians. The vibration was so strong that it lifted even more dust from the nearby construction areas. At 20%, the scene took on the feel of a movie: suspended dust, rising noise, tension in everyone’s eyes. ‘It looked like a scene from Raiders of the Lost Ark, when the villains open the Ark and everything starts shaking,’ recalls Jaime Melo, who was present during the test. At 30%, the noise became deafening; with the floor vibrating and the apprehension evident on everyone’s faces, the procedure was suspended.

Directors, engineers, and Dongfang technicians exchanged silent glances. The question was obvious, even if unspoken: What now? After a round of analyses and discussions, a



Brazilian and Chinese technicians participate in the test of the armored substation (above and on the opposite page).



decision was made: to take the turbine directly to 150% of its nominal rotation in a single leap.

When the technician gave the thumbs-up to authorize the test, everyone on site held their breath. Some closed their eyes. Others prayed. Within seconds, the turbine reached the critical speed — and held. No damage. No failure. A brief moment of silence was followed by an outburst of relief and applause. The tension turned into euphoria.

— Good thing — everyone very scared!” exclaimed Eva, the interpreter who bridged communication between the Brazilian and Chinese technicians, smiling nervously and stumbling over her Portuguese.

Hugs, laughter, and applause brought the experience to a close. Generating Unit 29 was ready to enter operation. With the first synchronization completed, the effort shifted to putting the remaining turbines into service as quickly as possible. The goal was to synchronize 21 units in 2014, allowing Jirau to reach a total of 1,650 MW by the end of that year. The challenge would once again gain an extra degree of difficulty. Saint Peter had a historic surprise in store for Rondônia. ■■■■

In hydrology and dam engineering, a ten-thousand-year flow is the term used to describe a water discharge that, statistically, has a chance of occurring once every 10,000 years. It is an extreme safety parameter used in the design of hydraulic structures such as dams, ensuring they can withstand exceptional floods. During the construction of the Jirau Hydroelectric Plant, as in similar projects in the country, this concept was taken into account in the design. But no one imagined it would be put to the test so soon: less than six months before the first turbine entered operation, the Madeira River experienced a flood with a 300-year recurrence interval.

Between January and March 2014, a series of exceptional rains caused several rivers in the southwestern Amazon to reach levels never before recorded. The Madeira River, the region's main watercourse, reached an impressive 19.74 meters in Porto Velho on March 30, exceeding the official emergency level of 16.68 meters by more than three meters. Until then, the highest recorded level had been 17.51 meters, in April 1997.

The Madeira River's discharge reached about 60,000 cubic meters per second — well above the volume recorded during the largest known flood until then, in 1984, when the river reached 48,000 m³/s. At the time, there were no dams on the Madeira

In Rondônia, more than 6,000 families were directly affected by the 2014 flood. The city government of Porto Velho declared a state of public calamity.

River, and the press showed that the water reached the rooftops of houses in Jaci-Paraná. The 2014 flood was considered tricentennial, with a theoretical probability of occurring once every 300 years.

Jirau, however, had been designed to withstand up to 82,000 m³/s, a value close to the so-called ten-thousand-year flow. The phenomenon was driven by extreme rainfall in Bolivia and Peru, from where more than 70% of the water feeding the Madeira originates. In Rurrenabaque, a Bolivian city on the banks of the Beni River (an important tributary of the Madeira), rainfall reached 1,829.9 mm between January and March — a level 122% above the historical average for the period. The consequences in the neighboring country were devastating with more than 50 deaths and around 400,000 head of cattle lost in the floods.

In Brazil, the impact was also severe. In Rondônia, more than 6,000 families were directly affected across ten municipalities, totaling approximately 30,000 people displaced or impacted. The city government of Porto Velho declared a state of emergency on February 14 and, on the 27th of the same month, a state of public calamity. Estimates pointed to losses of around R\$ 4.2 billion, which led the state government to launch a reconstruction plan. Floodwaters even inundated sections of the BR-364 highway, isolating the state of Acre for several days.

For Jirau's engineering and operations teams, the flood represented an extreme and unexpected test. Their routine shifted to reinforcing daily monitoring of weather conditions in Bolivia and Peru, from where most of the water feeding the Madeira River originates. On site, the floodwaters did not directly affect the facilities, but Jaci-Paraná was severely hit, compromising the



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One of the most critical points was the plant's control room, where operators monitored the performance of the turbines. If the floodwaters reached the area, it could prevent new units from entering operation and even jeopardize the turbines that had already been commissioned.

project's logistics. Thus, a temporary infrastructure had to be set up between the village and the plant: additional ferries were mobilized to transport food, materials, and personnel.

For the engineering, construction, and operations teams, the event raised concrete concerns about delays and structural risks. Civil construction was progressing at a rapid pace, and part of them were concentrated in sensitive areas downstream of the Madeira River. There, cofferdams were used — temporary structures that allow submerged areas to be dried so work can be carried out on solid ground. With the river level rising continuously — about 50 centimeters per day —, There were fears that these structures

could be swept away by the force of the current, jeopardizing worker safety and the project's schedule. And the risk did not end there.

Cranes and large assembly equipment were also operating in low-lying areas, and there was concern that they could be displaced by the rising waters. One of the most critical points was the plant's control room, where operators monitored the performance of the turbines. If the floodwaters reached the area, it could prevent new units from entering operation and even jeopardize those already commissioned. The solution was an emergency measure: the team decided to raise the control room's protective wall by 1.5 meters, reinforcing its defense against the flood.

Faced with the urgency of the situation, the plant's engineering director, Maciel Paiva, brought the issue to the National Electric System Operator (ONS) — the entity responsible for centralized energy dispatch throughout the country. In a decisive meeting, Paiva warned that, without intervention, up to 14 turbines could be flooded, which would mean multimillion-dollar losses and the need to rebuild at least one of the riverbanks. The ONS granted the request and ordered the lowering of the reservoir level at the Santo Antônio Hydroelectric Plant, relieving the pressure on Jirau.

This scenario unfolded at a particularly critical moment in the schedule. Jirau was completing its civil construction and moving into the commissioning phase of multiple turbines. In February 2014, five months after the first unit entered operation, another five generating units were in the final stages of testing, in a true race against time to recover delays accumulated since the beginning of the project. **“It was a moment of great tension, but we managed to keep going without the floods halting our work or**



The flood coincided with a moment when efforts were focused on bringing several turbines into operation, recalls Isac Teixeira

causing irreversible damage. That allowed us to stay focused on commissioning a record number of units,” says Isac Teixeira.

When the rains in Bolivia began to subside and the Madeira River level dropped, the pace of work accelerated: in 2014, 21 turbines were installed. Commissioning a generating unit is a complex activity that involves activating systems individually, testing them, analyzing their performance, and gradually integrating them until the final performance test. It is a process that takes time. ‘On average, in the market, it used to take 90 days for each unit, but we managed to do it in 30 days, with parallel work fronts and an operations team fully committed to the task,’ recalls Isac Teixeira.

The historic flood led part of the population and the press to question the impact that the operation of the Santo Antônio and Jirau hydroelectric plants might have had on the state. According to an assessment by the Brazilian Geological Service (SGB), the agency responsible for monitoring the Madeira River’s flow, the two projects bore no responsibility for the event: because they are run-of-river plants, they do not retain water and operate by

President Dilma Rousseff flew over the region affected by the floods and visited the plant



releasing downstream the same amount of water they receive. The flood, therefore, was the result of an extreme hydrological event, associated with exceptional natural conditions in the Madeira River basin.

On March 15, President Dilma Rousseff flew over the region to observe the damage firsthand. After a 40-minute flight over the most affected areas, she stated that the volume of the Madeira River could not be attributed to the Santo Antônio and Jirau hydroelectric plants. ‘It is absurd to attribute responsibility for the historic flood to the plants,’ said the president, who traveled along the stretch between Porto Velho and the border with Acre.

To assist the victims, the Ministry of Health sent 6.25 tons of medicines and supplies. The federal government mobilized Navy marines, Army personnel, members of the National Public Security Force, as well as aircraft from the Brazilian Air Force. Although the plant had no direct influence on the river’s flooding, the company acted in a supportive and responsible manner in assisting the State and Municipal Civil Defense authorities. The actions covered essential areas, such as housing, food, transportation, education, and

health, reinforcing the company's commitment to the well-being of local communities and its coordinated action with public authorities during emergency situations.

The flood prompted the local Public Prosecutor's Office and the Federal Public Defender's Office to hold hearings to determine whether the construction of the plants had contributed to the surge in water levels. A lawsuit seeking compensation for damages and losses suffered by riverside communities is still ongoing in court. In response to the historic event, a new hydrological forecasting system was developed in 2015 through a technical-scientific cooperation agreement between ESBR and the National Center for Monitoring and Early Warning of Natural Disasters (Cemaden), enabling medium-term forecasts to be improved by up to 15 days.

To further improve flow monitoring, in August 2016 an agreement was signed with Peru's National Water Authority (ANA-PE), through its regional office, the Administrative Water Authority XVIII — Madre de Dios, for the installation of a hydrometric station on the Madre de Dios River, in the city of Puerto Maldonado. The company supplied and installed the equipment, while the neighboring country became responsible for its operation and maintenance. The partnership strengthened the ability to anticipate critical events originating in neighboring countries.

In 2022, the Jair Bolsonaro administration delivered the elevation of 10.34 km of the BR-364 highway and the Velha Mutum Paraná bridge (220 m) in Rondônia. The project, designed by Jirau Energia and approved by the DNIT, followed the backwater levels defined by the National Water Agency (ANA) to prevent new



In 2022, during the Jair Bolsonaro administration, the project to elevate 10.34 km of the BR-364 highway and raise the Velha Mutum Paraná bridge, which spans 220 meters, was completed. The project aimed to prevent flooding from the Madeira River, such as the historic 2014 event that completely blocked sections of the road and isolated the state of Acre.

flooding events like the historic 2014 rise. Through an agreement, Jirau Energia funded the R\$ 14 million invested in raising the right-bank access of the bridge over the Madeira River, in Abunã, consolidating a legacy of regional integration.

According to DNIT, the BR-364 is the main logistics corridor for supplying the state of Acre and a key component of the Transoceanic Route. This axis is vital for transporting production from Mato Grosso, Rondônia, and Acre to the Pacific Ocean, via Chilean ports, with destinations in Asia. Around 8 million tons of grain travel along this stretch every year. In addition to its strategic importance for agribusiness, the works ensure safety and uninterrupted traffic, eliminating closures during flood periods and guaranteeing comfort for users who depend on this essential connection in northwestern Brazil. ■■■■

The morning of December 16, 2016 was marked by emotion and celebration. For the thousands of people who had participated directly or indirectly in the construction of the Jirau Hydroelectric Plant, that day symbolized the closing of a cycle.

Seven years after construction began, the project was officially inaugurated, with all 50 units operating in sync and capable of generating enough energy to supply more than 40 million people.

Started in 2009, the construction works faced numerous challenges — technical, climatic, social, and institutional — which required successive revisions to the schedule. A second planning phase projected that the 44th turbine would begin operating by November 2016, a target that was ultimately met seven months ahead of time, the result of coordinated efforts between the consortium, the operators, and the technical teams. Meeting the goal ahead of schedule earned Jirau an ‘A’ rating from Aneel, the highest recognition for commitment to deadlines and quality. ‘But it wasn’t easy,’ as many would repeat that day.

In his speech, with his voice choked by the emotion of the moment, Victor Paranhos highlighted the scale of the plant:

— Jirau was born as one of the greatest challenges in engineering. More than 22,000 workers and 7,500 tons of steel. It is a global reference.

Paranhos recalled the boldness of the project and highlighted one of its most important milestones: the shift in the plant’s dam axis, moved 9 km downstream after the auction.

— This decision made it possible to optimize the project, reduce

The start-up of the last turbine, on December 16, 2016, marked the completion of the Jirau construction and was celebrated at an event attended by the Minister of Mines and Energy, Fernando Coelho Filho.



environmental impacts, and generate savings that were passed on to consumer tariffs. It was a proposal that stood out in the electricity sector for its boldness.

According to him, that moment was the result of a group of people who never gave up on carrying forward the victory achieved in the 2008 auction. He recalled the most difficult moments — the fires in the accommodations, the 2014 flood, the delays — and made a point of honoring all those who contributed decisively to the completion of the project, mentioning two names that, for him, symbolized the dedication of hundreds of professionals: Thais Ferraz Soares, his direct advisor and the first employee hired by the consortium; and Jacintho Alvares, from Leme Engenharia, responsible for coordinating the execution of the project at the construction site.

Leme, in fact, played a central role: 260 professionals were dedicated exclusively to the project, representing about 30% of its technical staff. The company set up a robust structure, with offices in Porto Velho, Nova Mutum Paraná, Belo Horizonte, and Florianópolis, in addition to supervision and validation teams stationed at equipment factories.

When he stepped up to the microphone, Mauricio Bähr was also overcome with emotion. The setbacks experienced since the auction flashed through his mind. He had lost many nights of sleep over the incidents that marked the project's trajectory. Between Brasília, Rio de Janeiro, Porto Velho, Nova Mutum Paraná, and Paris, he had dozens of difficult conversations with the federal government, shareholders, banks, and the consortium's board. In both Portuguese and English, he discussed fires, floods, schedule changes, the withdrawal of construction companies, and regulatory challenges.

In moments of greatest tension, Mauricio would turn to a symbolic image taken from cinema: the scene in Titanic in which a lobster tank shatters in the dining room during the shipwreck — and the lobsters escape

In moments of greatest tension, Mauricio would turn to a symbolic image taken from cinema: the scene in Titanic in which a lobster tank shatters in the dining room during the shipwreck — and the lobsters escape. 'There is always a way out,' he would repeat to himself. In leading the project, Mauricio and Victor formed a complementary duo. While Mauricio acted as the diplomat, negotiating with the government, investors, and banks, Paranhos was the executor, overseeing construction, engaging with suppliers, and leading the team in the day-to-day work at the site. Despite some difficult conversations along the way, they always reunited around the greater goal of delivering the project.

In his remarks, Mauricio emphasized that resilience, perseverance, and professionalism were fundamental to the execution of the plant:

— Jirau is the largest project we have developed in the past 20 years," he noted, adding that, with construction completed, the focus would now shift to the operation of the enterprise.

Next, the then Minister of Mines and Energy, Fernando Coelho Filho, emphasized:

— The plant is yet another contribution to the country's energy security. A clean source of energy. We take great pride in the role of hydropower in our energy matrix, and we want to continue expanding renewable generation. **I believe that Jirau, in the middle of the Amazon rainforest, with all the obstacles it faced and the environmental achievements it delivered, serves as an example for other projects.**

"I did not experience many of the project's initial challenges as minister, but it was impossible not to feel the euphoria over the difficulties that had been overcome," he recalls today. ■■■■

With the operation of the 50th turbine, Jirau became one of the four largest hydroelectric plants in Brazil and strengthened the country's energy security





**Nova Mutum
Paraná**



On August 1, 2010, hundreds of residents of Mutum-Paraná set off toward a new life. Six full buses departed for the place that would become the future district, built a few kilometers away on a two-million-square-meter site. Along the way, still inside the vehicles, the debate began: what should this new locality be called? ‘Names like Mutum, Novo Mutum, Vila de Novo Mutum were suggested... until a consensus was reached: Nova Mutum Paraná,’ recalls Francisco Lima Ferreira, a witness to that historic moment.

Located along the BR-364 highway, Nova Mutum Paraná was conceived as a model urban reference, with a focus on sustainability and quality of life.



Francisco Lima Ferreira



The official inauguration of the district would take place in January 2011, but six months earlier the new infrastructure was already surprising the first resettled residents.



The district would only be officially inaugurated in January 2011, but it was already surprising those who arrived in August 2010. Dona Maria Nazaré, who for years had traveled dirt roads hitchhiking rides with truck drivers to sell flour in the village of Cruzeiro, watched the changes through the bus window with attentive eyes. The first thing she noticed: the streets were paved. In old Mutum, summer was marked by clouds of dust that seeped into the wooden houses and into people’s clothes, while winter brought mud and dirty boots. Asphalt, until then, existed only on the BR-364.

Another detail caught her attention: there were no more pay-phones. She soon learned why — there was now a telecommunications network, mobile phone service, and even cable TV. The

long lines to use the phone at the market or the payphone in the central square were now a thing of the past. She smiled as she recognized the church — brand-new and freshly painted — just a few steps from where she would live. She would no longer need to walk long distances to pray or take part in celebrations.

When she opened the door to her new house, astonishment gave way to emotion. Concrete walls, fresh paint, running water, a hot shower. Dona Maria Nazaré, who had lived for decades in stilt houses, now found herself in a home with a sewage system, a backyard lawn, and a bathroom with a toilet — something unprecedented for many residents of old Mutum-Paraná. There were no more open pits or improvised dumps. Electricity no longer came from diesel generators — it was stable and continuous. You could turn on the light with a simple touch of the switch.

With 1,600 houses, capacity for 6,000 residents, and an industrial hub designed to host 26 factories, Nova Mutum Paraná was not conceived as a dormitory town. It was designed as a model urban reference, with a focus on sustainability and quality of life. The infrastructure included full basic sanitation, regular electricity, fixed and mobile telecommunications, broadband



Dona Maria Nazaré



Electricity no longer came from diesel generators — it was stable and continuous — the streets were now paved, and the houses were built in masonry.



internet, selective waste collection, public squares, and leisure areas, elementary and high schools, a bus terminal, a post office, a health clinic, a bank branch, a supply center, a commercial area, and a space for an open-air market for local farmers. In addition, the project included specific zones for the installation of medium- and large-scale industries.

Nova Mutum Paraná symbolized one of the largest planned urban relocation efforts in Brazil's recent history, not only as a mitigating measure for the construction of the power plant, but as an urban legacy designed to endure.

If the river had been the gathering place for people in old Mutum, in the newly created district the sports club took on that role across generations. Informally, it was called Generating Unit 51 — ‘a good idea.’ A commercial center was opened and donated to local merchants. The building had 16 commercial rooms for diverse businesses, and 12 of them were already operating with clothing shops, computer products and services, a pharmacy, an ice-cream shop, a lottery retailer, and a cell phone operator.

The Lumiar Hotel, owned by Dona Ana, was also relocated to the new address, becoming an important support point for employees and visitors who stayed there and spent long hours at the power plant, whether during the construction period or once the project was already operational. ‘Many times, I would arrive at ten o'clock at night, after a long day, and Dona Ana would have a plate with my dinner ready, just waiting to be heated,’ recalls Jacintho Alvares, from Leme Engenharia, who was responsible for coordinating the project's execution during the construction phase. **‘We developed a relationship of care with those who work at the plant,’ says Dona Ana.**



The new town gained a sports club and a health clinic, and the hotel was relocated, becoming an important support point for employees and visitors.



Community health agents worked from Jaci-Paraná to Ponta do Abunã, covering the entire area influenced by the project. To support field activities, five pickup trucks were purchased.



The transformation of the community could also be seen in the health sector. Before, treating a stronger flu could mean hitching a ride with truck drivers or relying on Mutum-Paraná's only ambulance to reach Jaci-Paraná or Porto Velho — a trip of dozens of kilometers. Now, that routine was changing. The health structure installed in Nova Mutum Paraná was equipped to serve the roughly 6,000 residents of the relocated town — a population ten times larger than the initial estimate made in 2000.

The primary care unit had six beds, a laboratory, vaccination rooms, triage, outpatient facilities, an administrative area, and modern equipment such as biochemical analyzers, centrifuges, microscopes, autoclaves, cardiac monitors, hospital beds, and surgical instruments. In addition, three brand-new ambulances were acquired.

The structural change was accompanied by a significant shift in the region's public-health standards. Andressa Rocha, a resident of the area since childhood, grew up afraid of malaria — an endemic disease in Rondônia for decades that overwhelmed local health systems. With the new structure in place, that fear began to lose its strength. The control of the transmitting mosquito and the drastic reduction in cases challenged one of the main arguments

used by critics of the project during the licensing of the Madeira River power plants: that the project would trigger an explosion in cases of the disease.

This prediction, however, did not come to pass. On the contrary, there was an unprecedented coordination effort between the state and municipal health departments, in partnership with the Jirau and Santo Antônio power plants, which resulted in the implementation of the Public Health Program, launched in 2009. Coordinated actions for prevention, vector control, and treatment were put in place, along with the acquisition of equipment and the training of teams.

Community health agents worked from Jaci-Paraná to Ponta do Abunã, covering the entire area influenced by the project. To support field activities, five pickup trucks were purchased, along with materials such as boots, masks, and respirator cartridges. Thousands of mosquito nets were also distributed to the river-side population.

The result was significant: a reduction of more than 80% in malaria cases. Porto Velho, which for years had ranked among the areas of high incidence of the disease, came to be classified as a medium-incidence region and, for a period, even entered the low-incidence zone. With infrastructure, prevention, and continuous investment, Nova Mutum Paraná offered more than masonry houses and paved streets. It brought dignity, access to healthcare, and epidemiological security to a population that had lived for decades with improvisation and the absence of the State.

The doctors noticed another important change, says Orlando Leite, who has worked on the project since 2008. There had been



Residual spraying for malaria prevention in Nova Mutum Paraná, in September 2013

concern that the excavation of the reservoirs could mobilize mercury that had accumulated in the river over decades of gold mining, increasing the concentration of the metal and affecting the health of riverside communities. This was another criticism raised by opponents of the project during the licensing debates in the 2000s. The upper Madeira River basin was the second-largest artisanal gold-mining region in the Amazon from the 1970s to the mid-1990s. It is estimated that around 90 tons of mercury were released into the environment during that period.

To address this concern, Jirau Energia invested in an innovative project funded by Aneel's Research & Development program, in partnership with renowned institutions such as the University of Brasília Foundation (UnB), the National Institute for Amazonian

Research (Inpa/MCTI), the University of Campinas (Unicamp), São Paulo State University (IQ-Ar-Unesp), the Foundation for the Support of Science, Technology and Education (Fapct), and Venturo Environmental Analyses. Named ‘Biomarkers of Mercury Toxicity Applied to the Hydropower Sector in the Amazon Region,’ the project, launched in April 2013, aimed to expand knowledge about the presence of the metal in the region and improve environmental monitoring. **In addition to confirming that mercury levels around the plant are within the ranges recorded for the Amazon, the study brought important findings.**

Divided into three thematic areas — environmental aspects; metallomics and ichthyofauna; and metallomics and breast milk — the project resulted in six master’s dissertations, eight doctoral theses, and several scientific articles and seminars. Among its main findings was the conclusion that the high levels of mercury in Amazonian soil are not directly related to gold-mining activity — an association that had prevailed in both scientific and popular understanding until then — but rather to the natural characteristics of the soil itself. Proof of this is that high levels of the metal were detected even in areas where mining had never occurred, as indicated by the research data. ■■■

A partnership with renowned institutions made it possible to expand knowledge about mercury — whose levels are naturally quite high in the region’s soil — and to improve environmental monitoring

Starting in August 2010, when the first buses arrived carrying the residents who would be resettled, a new reality began to take shape in Nova Mutum Paraná.

The history of Rondônia has always been intertwined with the Madeira River. In the late nineteenth and early twentieth centuries, to overcome navigation challenges and transport rubber production between Brazil and Bolivia, the legendary Madeira-Mamoré Railway was built, linking Porto Velho, on the Madeira River, to Guajará-Mirim, on the Mamoré River. Conceived by American financiers, the railway made its first trip in 1912 and its last in 1966, during the Castello Branco administration, when the BR-364 highway began receiving investments and became the main access route to the capital of Rondônia, which until then had been connected only by river or air.

The legendary Madeira-Mamoré Railway, built between the late nineteenth and early twentieth centuries to overcome navigation challenges and transport rubber production between Brazil and Bolivia.





The railway made its first trip in 1912 and its last in 1966, when the BR-364 highway became the main access route to Porto Velho.

Along a stretch of that railway, near the BR-364 highway and on the banks of the Madeira River, Mutum-Paraná was born — a portrait of Rondônia's own history. Its growth followed the region's economic cycles: it began with rubber, continued with the logging that supplied the railway, and later with the expansion of gold mining in the 1970s and 1980s, when the gold rush attracted thousands of migrants. Rondônia would become a state in 1981, and at the height of the mining boom, people in Mutum-Paraná used to say it was possible to cross the river by jumping from boat to boat, so numerous were the vessels. With the decline of gold, the town fell into decay: without mining, what remained were small exchanges among residents and the movement of trucks passing through the area.

The arrival of the power plant transformed this scenario. Early on, information centers were opened in Porto Velho and in Mutum-Paraná to present the project and the planned social and environmental actions. The selection of the resettlement area was made during a public meeting with the community.



From the outset, the proposal was to integrate the resettled families with the plant's employees and service providers who would live in the region during the operation of the project. **This coexistence would bring new dynamism to the local economy, strengthening commerce and services and offering residents a foundation for autonomy and growth. It would also allow the resettled population to remain in its territory of origin, an important aspect from an anthropological perspective.**

Residents of the former Mutum-Paraná were offered three alternatives: (1) compensation for relocation; (2) a credit letter to purchase a home or business elsewhere; or (3) a house built in the planned neighborhood. Rural producers, in turn, would be included in the Collective Rural Resettlement Program (RRC), aimed at residents of areas affected by the plant's reservoir. Most chose to move to the new urban area, where professional opportunities were beginning to emerge and pointed toward a promising future.

Ueime Rodrigues, born in Porto Velho, was one of these people. She arrived in Nova Mutum Paraná in August 2010 with her son Wandrey, then two years old, and her daughter Wemilly, who was only 15 days old. Her husband, Anderson Oliveira, a butcher in the former locality, remained in Mutum-Paraná for a few more months. A friend told her about a job opening in the plant's administrative area. Ueime applied and was selected. On December 1, 2010, she began working at the plant's gatehouse, checking incoming equipment. She soon realized that the environment encouraged professional growth. A year later, she decided to pursue a degree in Systems Analysis and, with her



With the arrival of new families, the demand for education surged. Schools in the region received additional support and new infrastructure.



Anderson Oliveira

diploma in hand, she began a second undergraduate degree, in Accounting. She wanted to grow.

Anderson also rebuilt his life: he left his previous job and moved to Nova Mutum in 2011, finding work with a company that provided electromechanical assembly services. In 2017, after completing a course offered by Senai, he was hired directly by the plant. At the same time, he began a blended-learning program in Electronic Engineering. In 2020, they managed to buy their first brand-new car.

“My life changed completely. My children are now in Porto Velho — my son is studying Biological Sciences, and my daughter wants to become a veterinarian,” says Ueime, moved as she recalls her own journey. Today, with her degree completed, she works as a tax assistant at the plant. **“When we arrived in the old Mutum, we had nothing. The house was rented, made of wood, right by the river. Sometimes we spent days without water or electricity. Today it’s a completely different reality. My children will have a future I never imagined for myself.”**

Ueime and Anderson’s children studied in the local school system, which underwent a profound transformation — both

The traditional Nossa Senhora de Nazaré Municipal School was expanded to serve 450 students from the 1st to the 9th grade, with new classrooms and reinforcement in the teaching staff.



in Nova Mutum Paraná and in Jaci-Paraná. **The proposal was clear: to raise the quality of education at all levels and expand opportunities for young people in the region, encouraging them to stay in school and pursue technical courses and higher education.** In the old Mutum, a single school served just over 400 students. With the arrival of the families of plant workers and the resettlement of the original residents, demand jumped to more than 1,200 students of different age groups.

With a focus on early childhood education, the Encantos de Mutum Municipal Early Childhood Education School was created. With a modern structure, it includes six classrooms, a pantry, kitchen, cafeteria, playroom, covered courtyard, sports court, and administrative areas. The traditional Nossa Senhora de Nazaré Municipal School was expanded to serve 450 students from 1st to 9th grade, with new classrooms and a strengthened teaching staff.

In partnership with the government of Rondônia, the Center for Scientific Initiation and Technological Innovation was opened on November 6, 2018, in Nova Mutum Paraná — an initiative made



The investment in education was strengthened with the construction of the Tiradentes Military Police School (CTPM II) in Jaci-Paraná, with capacity for 800 students from the 6th grade of elementary school through the 3rd year of high school.

possible by ESBR, which invested around R\$ 2 million using subsidized resources from the BNDES social sub-credit. The space was designed to promote the social development of the region, encouraging scientific initiation projects, research, and technological innovation among children and young people. To implement the initiative, an agreement was established with the government of the state of Rondônia, which became responsible for the operation and maintenance of the Center, under the pedagogical guidance of the Tiradentes Military Police School II (CTPM II).

These investments opened pathways for a new generation. Andressa Rocha arrived in Mutum Paraná at the age of five and, at 16, moved to Nova Mutum Paraná along with the rest of the community. She studied at the Nossa Senhora de Nazaré School, took part in social projects organized by the Socio-Environmental Observatory, and earned a degree in Administration through a blended-learning program in Porto Velho. Today, she is an employee of the plant. Her mother, Maria da Conceição, worked as a cook for a company



The Science and Technology Center features laboratories for robotics, the Internet of Things, computing, and food technology, as well as a library, study room, and high-speed Wi-Fi. In the photo on the right, Gabriel Mota, a standout student at the CCT, is now an employee of Jirau Energia.



providing services to the hydropower plant, and her sister Waleska studied at the Einstein School during elementary school and later at the military school, where she completed high school.

Another example is that of Gabriel Mota, whose entire educational path was directly linked to the educational structures created as social compensation by Jirau Energia. A student at CTPM II and an active participant in the activities of the Science and Technology Center, Gabriel took courses in Robotics and Programming. In 2019, he won 3rd place at the Milset Brazil National Expo, held in Fortaleza (CE), with an innovative project: a low-cost sensor designed to detect leaks of liquefied petroleum gas (LPG). The device emits an audible alarm, activates a warning light, and automatically triggers a valve that shuts off the gas supply, helping to prevent accidents.

Gabriel joined Jirau's technical trainee program, marking the beginning of his professional journey.

In the countryside, a different reality was also taking shape.



One of the initiatives aimed at cooperatives is the production of native seedlings to restore degraded areas and support local development.

In 2011, 35 families were relocated to the Collective Rural Resettlement — by 2025, around ten remained. Each family received, on average, 75 hectares of land and a house in Nova Mutum Paraná. Before, they lived in hard-to-reach areas on the left bank of the Madeira River, where transporting their banana and açaí production depended on boats and expensive freight. They lived from fishing and subsistence farming, facing structural hardships.

In the resettlement area, residents began to have the conditions needed to diversify and expand their production. Jirau Energia hired a specialized company to provide technical and social assistance, with teams composed of agronomists, agricultural technicians, and social workers. Since 2009, they have accompanied the transition process, offering continuous support.

Each property received complete infrastructure: a 16 m² masonry storage building, electricity, a water supply system with a semi-artesian well and pump, a septic tank, wire fencing, access



In the resettlement area, residents began to have the conditions needed to diversify and expand their production. Each property received complete infrastructure: a 16 m² masonry storage building, electricity, a water supply system with a semi-artesian well and pump, a septic tank, wire fencing, access via local rural roads, and internal gravel roads totaling 8.5 km

via local rural roads, and internal gravel roads totaling 8.5 km.

The effort toward training and productive inclusion paid off. If geographic isolation had once limited the development of these families, access to education, healthcare, mobility, and markets now opened doors to a new stage of life. For the children of the resettled families, the possibilities were far broader than those available to previous generations.

This entire strategy gained international recognition in May 2015, during the 5th World Congress of the International Hydropower Association (IHA), held in Beijing, China. Jirau took part in the congress on a panel about resettlement, presenting the Relocation Program for Populations Affected by the Jirau Hydropower Plant and the construction of Nova Mutum Paraná. Thais Soares, advisor to the presidency, described the strategies, challenges, and solutions of one of the success cases showcased at the event. ■■■■

Shortly after taking over Jirau's finance and institutional relations department in 2017, Julio Freitas was caught by surprise by an emblematic episode.

Residents of Nova Mutum Paraná, in protest, had blocked a stretch of the BR-364 highway near the access road to the project. On site, men, women, and children held up signs with their demands — the main one related to failures in school transportation for children and adolescents, a service under the responsibility of the Porto Velho city government and the state government.

Newly arrived and still unknown to the community, Julio decided to act. He asked the residents to set aside their distrust and choose five representatives for a direct conversation with him inside the project site. They accepted the invitation. In the meeting room, Julio went straight to the point:

— Let's talk and set deadlines. Whatever I commit to, you will get answers and you'll be able to hold me accountable. I'm new to the city, but this project is here to improve everyone's life.

With a road network of about 7,000 kilometers of rural access roads, Rondônia faced many challenges in school transportation, and Nova Mutum Paraná was no exception. The community's main complaint was the difficulty of traveling between the district and Jaci-Paraná, where the Tiradentes Military Police School (CTPM II) was located.

At the end of the conversation, Julio took the representatives on a visit through the plant's facilities and, as they said goodbye, he



In 2017, residents of Nova Mutum Paraná staged a protest and blocked a stretch of the BR-364 highway near the access road to the project. Their main complaint was the difficulty of getting students to school. Newly arrived at Jirau, Julio Freitas met with community representatives and restored everyone's confidence. A bus was donated exclusively for school transportation between Nova Mutum and Jaci-Paraná. The road was never blocked again.

The traditional Flor do Mutum festival is a symbol of community life, identity, and the shared sense of belonging.



handed each of them his cellphone number. A few days later, after the protest had ended, he sat down with representatives from the city government and the state government to seek a solution. The result came quickly: a bus was donated to the municipality exclusively for school transportation between Nova Mutum and Jaci-Paraná. The road was never blocked again.

The relationship with the community continued to grow stronger, and from that point on, the plant began to support and sponsor events that had long been traditional in Old Mutum, such as the Flor do Mutum festival — a celebration that symbolizes community life, identity, and the shared sense of belonging.

The following year, the company took an even bolder step. On Labor Day, May 1, 2018, during the celebration held at the Nova Mutum club, an unprecedented initiative was announced: employees who lived in Nova Mutum Paraná and had been with the company for more than six years would receive, free of charge, the deed to the house in which they lived. It was a gesture of



Cláudia Neri, one of Jirau's first employees, holding the deed to her home.

recognition and a way to strengthen the bond with those who had helped build the project.

The measure touched on a sensitive point. With an average age under 30, many employees were in their first job and living in rented homes. For dozens of them, owning a house was a distant dream. The donation of the homes turned that dream into reality. With his eyes welling up, Julio remembers:

— It was a way to ensure that this group also felt part of the city, helping build a sense of belonging in Nova Mutum Paraná.

In 2018, another initiative was put into practice that changed lives in Rondônia: support for Operation Smile, a volunteer medical organization that provides free surgeries for people born with cleft lip and palate. Facial clefts are very common. According to the WHO, every three minutes a child is born somewhere in the world with a cleft lip and/or palate, an opening that occurs in the upper lip.

The plant's support for the NGO Operation Smile made it possible to carry out more than five humanitarian missions in Porto Velho since 2018, resulting in new smiles for 227 people born with cleft lip and palate.



There are several degrees of lip involvement, ranging from a small scar-like mark to a partial or complete opening through the full thickness of the lip. Children born with these clefts face difficulties with breastfeeding, develop a nasal-sounding speech (especially in cases of a cleft palate), and often have altered tooth positioning. All of this can be treated, and corrective surgeries allow them to reintegrate into society and lead a normal life.

The plant's support for the NGO Operation Smile — which receives financial resources granted by BNDES — made it possible to carry out more than five humanitarian missions in Porto Velho since 2018. Since then, more than 3,800 free consultations have been provided to 435 families, resulting in new smiles for 227 people born with cleft lip and palate. In parallel, the plant's involvement was essential for the creation of the Rondônia Cleft Center (Nufis) at the Dr. Ary Pinheiro Base Hospital. ■■■



**Respect for the
environment and
for social well-being**



Aerial view of the Madeira River during the construction of the plant.

Caring for the environment, reducing impacts, and turning the project into a driver for preserving the Amazon biome have always been the three fundamental pillars behind the conception of the Jirau Hydropower Plant. From the outset, the plant was designed as a run-of-river project — taking advantage of the high flow of the Madeira River, with a low hydraulic drop and without the need for a large reservoir. The consortium’s team traveled to the region during the study phase for the concession auction to identify local social and environmental conditions and the alternatives with the lowest impact.

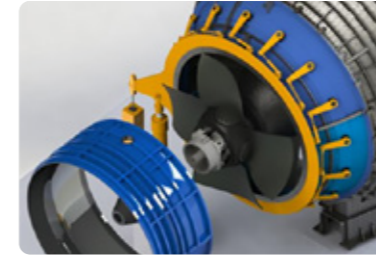


Diagram and real view of Jirau’s bulb turbines. Unlike conventional vertical turbines, this model allows water to flow almost in a straight line through the intake circuit, optimizing energy capture in run-of-river reservoirs with low hydraulic head.



First page of the installation license, granted in June 2009.

The turbines selected for the hydraulic design were bulb-type units, connected to a short intake circuit only 17 meters long, which helped reduce the flooded area in proportion to the installed capacity. These turbines also offer another environmental advantage: they are considered friendly to fish passage. This was confirmed through studies of eggs and larvae, which showed extremely low injury rates — around 1.5% — and through the telemetry program, which demonstrated that fish were indeed able to pass through the turbines.

The decision to shift the dam axis and align it with a natural island in the river made it possible to significantly reduce the amount of excavation and embankment work, thereby minimizing direct intervention in the environment.

These engineering criteria and technical solutions were essential for obtaining the installation license in June 2009. Among the most significant environmental measures was the concern for the ichthyofauna — the rich fish diversity of the Madeira River, especially its migratory species. **In response to fears that the construction of the dams could compromise the reproductive cycle of these fish, an unprecedented aquatic fauna rescue program was implemented, which later became a reference.**

The actions began in May 2009, even before the main construction works. In five areas enclosed by temporary cofferdams — structures built to divert the river’s flow during construction — more than 1 million fish were rescued over two and a half years, with over 200 species identified. This work was only possible thanks to a combination of factors: detailed planning, team training, the use of advanced technology, and the continuous monitoring of



Plagioscion squamosissimus (Silver croaker/corvina)



Colossoma macropomum (Tambaqui)



The fish rescue, carried out using nets and boats, was meticulous. First, the fish were transferred to plastic containers with running river water and then taken to a support station, where they were measured, weighed, identified, and placed in tanks with continuous oxygenation. After this process, they were returned to the main river channel, downstream from the construction site.



In 2015, researchers from the Swedish Water Management Agency visited the plant to observe the operation firsthand.

environmental parameters such as oxygenation, temperature, and water depth.

The operation was meticulous. The animals, captured with nets and boats, were transferred to plastic containers with running river water and then taken to a support station, where they were measured, weighed, identified, and placed in tanks with continuous oxygenation. After this process, they were returned to the main river channel, downstream from the construction site. Some migratory species were tagged for later monitoring, reinforcing the commitment to scientific knowledge.

In addition to the rescue efforts, it was necessary to understand the project's impact on migratory routes. One of the main recommendations came from specialist Sultan Alam, a consultant initially hired by the government to assess the environmental feasibility of the Madeira hydropower plants. After winning the auction, the consortium once again relied on his expertise, especially for sizing and testing solutions.

In partnership with the French institute Sogreah, a reduced physical model of the plant was built in Grenoble, France. The hydraulic mock-up — 40 meters long and 5 meters wide — reproduced a 30-km stretch of the river, 20 km upstream and 10 km downstream of the dam. There, it was possible to accurately study sediment dynamics, the movement of logs and floating materials, as well as the displacement of fish eggs, larvae, and juveniles.

This system has attracted the interest of specialists and environmental authorities from Brazil and abroad. In 2015, researchers from the Swedish Water Management Agency visited the plant to observe the operation firsthand.

In 2018, technicians from the Mato Grosso State Environmental Secretariat (SEMA-MT) visited Jirau with the aim of gathering the technical basis needed for issuing the environmental opinion required for the Sinop Hydropower Plant, which at the time was under construction in the neighboring state.

The concern for the region's wildlife led to the creation of the Wildlife Conservation Program, launched in 2010 and carried out continuously. The program identified more than 2,700 species, including 30 new to science, and contributed to mapping around ten species threatened with extinction. A recent study conducted in partnership with the Chico Mendes Institute for Biodiversity Conservation (ICMBio) confirmed that the area surrounding the reservoir presents suitable environmental conditions for the survival of these organisms. This partnership also includes Jirau's participation in the biodiversity monitoring program of the Matinguari National Park, which covers areas in the states of Amazonas and Rondônia, near the plant.

In the field of education and awareness, the Environmental Education Program has played an important role. Designed in a participatory manner, the project provided training to various social groups, benefiting more than 17,000 people through educational activities, workshops, lectures, and socio-environmental awareness initiatives. Its focus is to broaden environmental awareness and contribute to improving the quality of life of the communities surrounding the plant. ■■■



Representatives from Jirau, ICMBio, and the government signed an agreement for the Matinguari National Park in August 2010.

Jirau has become a driver of local flora and fauna preservation. Since 2010, the Wildlife Conservation Program has been maintained.



Aotus nigriceps (Night monkey)



Corallus batesii (Amazon tree boa)



Ara chloropterus (Red-and-green macaw)

Although the Jirau Hydropower Plant did not directly impact Indigenous communities, throughout the project's development there were episodes of misinformation that needed to be clarified.

One such case occurred in April 2010, when the French newspaper *Le Monde* published an article signed by writer Jean-Marie G. Le Clézio and by the director of Survival International, Jean-Patrick Razon. In the text, the authors claimed that the plant could threaten the survival of isolated Indigenous peoples in the Amazon. They cited data allegedly from Funai, according to which Indigenous groups living between 10 km and 30 km from the dam were fleeing the noise of the machinery and moving toward areas occupied by miners, increasing the risk of violent conflict.

The publication of the article and its wide repercussion among third-sector organizations in Europe led GDF Suez and the consortium responsible for the project to form a crisis committee. The first measure was to present information demonstrating that the Indigenous group closest to the dam axis was more than 100 km away. In addition, even though there was no direct impact, structured programs were already in place to support cultural preservation and environmental protection for the Indigenous communities in the region.

In response to Survival International, one of the project's leaders, Antonio Jorge, traveled to personally provide the clarifications. He demonstrated that the Indigenous peoples

Since the beginning of the project, a set of initiatives focused on Indigenous peoples has been implemented in the areas of health, education, and security.

mentioned in the article did not belong to isolated peoples, but were individuals who had voluntarily left their communities due to internal matters, and not because of the plant's construction, which was far too distant to be responsible for such movements.

Efforts were also made to show that the Indigenous Communities Support Program had been developed since the project's conception phase. From the outset, a set of initiatives aimed at Indigenous peoples was implemented, even though all of them were located outside Jirau's area of influence — the nearest Indigenous land is more than 100 km from the dam axis. These groups inhabit an area of approximately 2 million hectares of forest and include around 3,000 Indigenous individuals from five contacted peoples, as well as alleged isolated groups. Investments included the construction of surveillance posts, donation of vehicles and boats, installation of boundary markers and signage, georeferencing of territorial limits, and technical support for research expeditions.

In the field of education, 20 schools were built, each equipped with teacher housing, water wells, fully equipped kitchens, and computer labs. In the area of health, seven Indigenous Primary Health Units were constructed, along with 13 Household Sanitation Modules and chlorine dispensers for water treatment. Additionally, two Mobile Dental Units and vehicles for patient transportation were donated. A dedicated building was also established for the creation of the Indigenous Support Center, aimed at training Indigenous health and sanitation agents, including activities related to the collection and proper disposal of solid waste from the villages.



A series of initiatives was created for Indigenous communities. In education, 20 schools were built, equipped with teacher housing, water wells, kitchens, and computer labs. In the area of health, seven Indigenous Primary Health Units were constructed.



In April 2024, a Remote Territorial Monitoring course was offered to the Indigenous people of the Trincheira Village. The training enabled participants to master tools such as GPS and mobile applications for field data collection, as well as access websites containing relevant public information about their lands.



The program also aims to strengthen territorial protection by promoting awareness-raising and training initiatives so that communities can defend their rights and territories autonomously. In April 2024, a Remote Territorial Monitoring course was offered to the Indigenous people of Trincheira Village, located within the Uru-Eu-Wau-Wau Indigenous Land. The training enabled participants to master tools such as GPS and mobile applications for field data collection, as well as access websites containing relevant public information about their lands. They also learned to use software that supports the preparation and formal submission of reports to the competent authorities. The central objective of the workshop was to equip Indigenous participants to support the monitoring of isolated peoples, identify intruders, loggers, and other illegal activities within their territories, and respond quickly to potential fire outbreaks in the region. ■■■■

On Christmas Eve of 2009, at his home in Rio de Janeiro, the Environmental and Sustainability Director of the Jirau Hydropower Plant, Antonio Luiz Jorge, was preparing for a family dinner when he received an unexpected phone call from his team at the construction site in Rondônia. A worker, during earthmoving activities, had identified rock engravings in the region.

— What do we do?

— We need to call in a team of archaeologists and verify the discovery — replied Antonio Luiz, who immediately informed Victor Paranhos about what had happened.

From that episode onward, one of the most comprehensive archaeological, historical, and cultural heritage management efforts associated with an infrastructure project in Brazil began. The Madeira River region has records of continuous human occupation for approximately 10,000 years. As excavations advanced and specialists coordinated the work, 45 archaeological sites and 13 occurrence points were identified within the plant's area of influence. All material found was carefully sent to laboratories installed at the construction site itself, where it underwent curation and analysis. The collection, with more than 100,000 pieces, includes everything from complete funerary urns — later restored — to vessels, adornments, ceramic fragments, lithic and malacological objects, charcoal, wood, glass, and other artifacts representative of the region's ancient human occupations.

More than 100,000 archaeological pieces — including ceramic artifacts (funerary urns, vessels, adornments, ritual utensils), lithic material (axe blades, scrapers, flakes), and remnants of the Madeira-Mamoré Railway (EFMM) — were recovered within the area influenced by the Jirau plant and duly catalogued.





The Cultural Center of Nova Mutum Paraná served as a laboratory for the Federal University of Rondônia.

In June 2023, the Archaeological Technical Reserve of the Federal University of Rondônia (UNIR) was inaugurated, considered one of the largest of its kind in the country — and the only one designed exclusively for this purpose. Covering just over 2,000 square meters, the complex includes a reception area, four laboratories (ceramics, lithics, multipurpose, and conservation / restoration), quarantine and material-preparation rooms, a documentation center, an exhibition space, an administrative sector, and a technical area for storing the collection. The entire facility was equipped with state-of-the-art furniture and technology suited to each segment of archaeological activity. The reserve became the permanent destination of the collection, which until February 2021 had been temporarily stored at the Nova Mutum Paraná Cultural Center, in Rondônia, under the custody of the team of archaeologists and technicians linked to Jirau’s Archaeological, Historical, and Cultural Heritage Management Program (PGPAHC). ■■■

The Jirau Hydropower Plant also stood out for its pioneering role in the issuance of carbon credits. When it was tendered in 2008, the project had already been conceived based on the principles of the Clean Development Mechanism (CDM), within the framework of the National Policy on Climate Change. In 2012, the plant obtained official registration with the United Nations Framework Convention on Climate Change (UNFCCC), consolidating its commitment to emission reduction.

“One of Jirau’s major legacies is the plant’s contribution to reducing greenhouse gas emissions. Certified by the United Nations, it is the largest renewable-energy project in the world registered under the CDM, avoiding the emission of approximately 6 million tons of CO₂ per year,” says ENGIE’s Chairman of the Board, Jean-Pierre Clamadieu.

The project’s design, with its focus on reducing environmental impacts and preserving the surrounding area, was a key factor. But another element also contributed to the plant’s international recognition: the shift in Brazil’s electricity matrix following the 2001 rationing period. At that time, 90% of the country’s electricity came from hydropower. However, the expansion of thermoelectric plants — powered by natural gas and other fossil fuels — began to change this scenario. Between 1994 and 2007, thermal generation increased from 7,051 MW to 21,324 MW, raising greenhouse gas emissions from 10.8 million to 24.1 million tons of CO₂.



One of Jirau's major legacies is the plant's contribution to reducing greenhouse gas emissions,' said Jean-Pierre Clamadieu, Chairman of ENGIE's global Board of Directors, who visited the project several times.

According to data from the Electric Energy Trading Chamber (CCEE), in 2009, about 57% of the new capacity contracted since 2005 was from fossil sources. Jirau's entry into the system prevented this trend from intensifying even further. Without the plant, it was estimated that the national thermoelectric park would have been 22% larger than what was observed.

In 2016, with the completion of the commissioning of its 50 turbines, the United Nations recognized the project's first issuance of carbon credits: approximately 1.7 million units generated between July 2014 and February 2015, the period during which the generating units were being commissioned. The certification, carried out by TÜV Nord, followed UNFCCC methodology based on the amount of CO₂ avoided through the replacement of thermal energy with renewable energy. This initial process established Jirau as the largest decarbonization and clean-energy investment ever certified by the UN.



Jirau donated 70,000 carbon credits to the Rio de Janeiro State Secretariat for the Environment, contributing to the Greenhouse Gas Emissions Compensation Project for the 2016 Olympic and Paralympic Games.

The volume of CO₂ emissions avoided is calculated based on the reduction in fossil-fuel consumption resulting from the replacement of thermoelectric generation with the project's renewable electricity. During the certified period, this substitution was significant due to Brazil's energy crisis, which increased the demand for fossil-fuel-based dispatch — a demand that would have been even higher without the energy generated by Jirau.

The plant's contribution to emissions neutralization also extends to other areas. In 2016, the year Brazil hosted the Olympic Games, Jirau donated 70,000 carbon credits to the Rio de Janeiro State Secretariat for the Environment, contributing to the Greenhouse Gas Emissions Compensation Project for the 2016 Olympic and Paralympic Games.

Since 2020, the Rio Open, South America's main tennis tournament, has fully offset its greenhouse-gas emissions with the clean energy generated by the hydropower plant. In 2024, 1,713 tones of CO₂ equivalent (tCO₂e) were neutralized. Since the beginning of the partnership, the tournament has already compensated 4,686 tCO₂e.

Jirau was also evaluated using the Hydropower Climate Resilience Guideline and proved to be resilient to the five climate-change scenarios defined by the Intergovernmental Panel on Climate Change (IPCC) for its region. The document was developed by the International Hydropower Association (IHA) in partnership with the World Bank and is endorsed by the entire global hydropower industry. The results from the five plants tested were presented at the World Hydropower Congress in Paris in 2019.



In addition to its commitment to the environment, Jirau has actively contributed to the social development of the region's communities.

One of the key partners in this mission is the Jirau Socio-Environmental Observatory, created in June 2009, when the plant was still in its early stages. Among the projects maintained by the Observatory is the Learning Unit, which includes a hydroponic garden and soil-based planting beds. More than 100 kg of vegetables are produced weekly and sold to restaurants at the Jirau and Santo Antônio plants, as well as to establishments along the BR-364 highway.

Another impactful initiative is the Flor e Ser Mulher project, created in 2019 with the goal of promoting women's empowerment



One of the initiatives aimed at cooperatives is the production of native seedlings to restore degraded areas and support local development.

The Flor e Ser Mulher project was created in 2019 to promote female appreciation through health, entrepreneurship and community living activities.



through health activities, entrepreneurship, and community engagement. With its own dedicated facility, the project focuses on sustainability and the reuse of materials that would otherwise be discarded — such as banners, tarpaulins, and uniforms — transforming them into bags, totes, and other items sold by the participants. During the COVID-19 pandemic, more than 40,000 masks were sewn by the 30 women involved in the initiative.

Created in 2010 as part of the plant's Environmental Education Program, the Porto Velho Rural Producers Cooperative (COOP-PROJIRAU) is an important partner in revegetation efforts, the recovery of degraded areas, and the implementation of agroforestry systems. The cooperative collects seeds from native tree species in the region, combining environmental preservation with job and income generation. Since its founding, more than 600,000 seedlings have been planted. In 2024, it reached a new milestone by selling more than 10 tons of seeds to several companies, including the Amaggi Group and the mining company MRN, with whom it



The Porto Velho Rural Producers Cooperative collects seeds from native tree species in the region, combining environmental preservation with job and income generation. Since its founding, more than 600,000 seedlings have been planted.

established environmental restoration agreements. COOPPROJIRAU also maintains a partnership with Embrapa, further strengthening its technical and scientific activities.

This set of initiatives, structured since the plant's design phase, was essential for Jirau to obtain, in 2023, the highest level of certification under the Hydropower Sustainability Standard, granted by the Hydropower Sustainability Council. Jirau thus became the first hydropower plant in Brazil and the second in the world to achieve this level of excellence since the certification was created in 2021.

This achievement was the result of a rigorous independent assessment carried out by accredited auditors, who conducted on-site technical visits and thoroughly analyzed the project's performance across 12 environmental, social, and governance (ESG) topics. Jirau's performance exceeded international best-practice levels, meeting more than 60% of the criteria in all advanced requirements of the standard. This journey of evaluation and transparency began back in 2012, when the plant was assessed under the Hydropower Sustainability Assessment Protocol (HSAP), also developed by the Council. Following the 2023 certification, a

The achievement of the Hydropower Sustainability Standard certification was the result of a rigorous independent assessment carried out by accredited auditors, who conducted on-site technical visits and thoroughly analyzed the project's performance across 12 environmental, social, and governance topics.



60-day public consultation process was opened, allowing stakeholders to participate in the review of the audit's conclusions.

“Having conducted the initial assessment of the Jirau project using the HSAP during its construction phase, it is very rewarding to return after a decade of operations and witness the significant progress and consolidation of environmental and social initiatives, along with the positive impacts generated by the project,” highlighted Joerg Hartmann, leader of the 2023 assessment and a member of the 2012 evaluation team. “Because we had previously collaborated with Jirau Energia, we are optimistic about the continued commitment of this dedicated team in addressing remaining issues — especially those related to the livelihoods of local communities and aquatic biodiversity — even with the certification already having reached the Gold level.”

The commitment to environmental management was further strengthened in 2025 with the achievement of the ISO 14001:2015 certification, which recognizes the implementation of a robust and effective Environmental Management System (EMS) in compliance with international standards.

The certification attests not only to the fulfillment of legal requirements but also to the continuous pursuit of improvement, integrating environmental criteria into the company's business strategy in a structured and sustainable manner. ■■■■

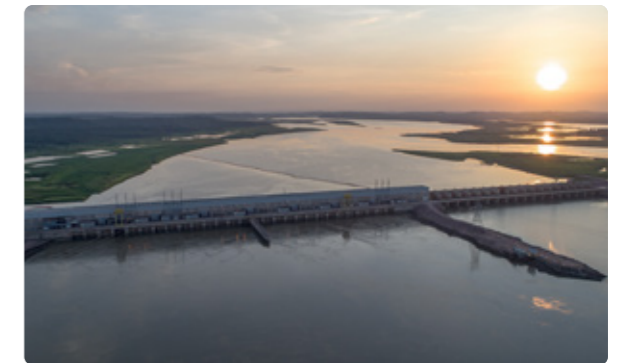


New Cycle

Christmas of 2018 brought good news: on December 23, the plant recorded 3,750.13 MW of generation, with all 50 generating units operating at full capacity — a performance 70% above its assured energy level of 2,205.6 MW. Ten years after winning the auction and completing the construction and installation of the equipment, Jirau was operating at a level of excellence.

A new cycle was beginning for the project, in which the focus shifted from construction to long-term continuity, with an agenda increasingly dedicated to regulatory matters. In this context, the shareholders of Jirau Energia decided to initiate a succession process within the executive board to ensure a planned transition of management, guaranteeing the continuity of ongoing projects and actions. 'Victor Paranhos played an enormous role in the project; he made it possible for Jirau to become operational despite all the obstacles. There were now other challenges ahead,' said Fabio Alves, who served as president of Chesf between 2018 and 2023 and as a board member of Jirau Energia.

Having been with ENGIE since July 2000 — and having taken part in the Santo Antônio and Jirau auctions — Edson Silva visited the plant for the first time in 2013, when he took over the company's strategy and regulation board. His next professional step came in the second half of 2019, when he was informally approached about taking over the leadership of Jirau. Before accepting, he recalled his first visit to the project, alongside Gil Maranhão and Carlos Gothe.



Full-load power. With all 50 of its bulb turbines in operation, Jirau has established itself as a pillar of national energy security, generating clean electricity for more than 40 million Brazilians. On this page, an internal view of the powerhouse on the right bank and panoramic details of the plant.



Edson's management would be structured around four pillars: financial discipline, operational performance, regulatory management, and the resolution of legal disputes.

With the indication that he would accept the position, he soon received a call from Mauricio Bähr. The Chairman of Jirau's Board of Directors formalized the invitation, emphasizing that the company's priorities would shift and that it would be essential to advance a regulatory agenda requiring close engagement in Brasília, as well as an energy-procurement strategy in light of the transformations in Brazil's electrical matrix. Edson replied that his management would be structured around four pillars: financial discipline, operational performance, regulatory management, and resolution of legal disputes.



Before accepting the invitation to take over the leadership of Jirau, Edson Silva recalled his first visit to the project, in 2013, alongside Gil Maranhão and Carlos Gothe.



Victor Paranhos, a central figure in leading both the construction and operational phases of the plant, would retire with a sense of mission accomplished, concluding a career of more than three decades of achievements in the electricity sector. He was the first president of Gerasul after its privatization, leading the company acquired by ENGIE. He also headed major projects such as the Cana Brava (450 MW), Estreito (1,087 MW), and São Salvador (240 MW) hydropower plants. In 2007, he was elected president of the consortium that would compete in the Jirau auction — a project that, with its numerous challenges, would become the greatest test of his career.

Victor was known for his direct style and hands-on approach. He had no driver: he insisted on driving himself from the airport to the plant. He would arrive at the hydro-power facility before seven in the morning and climb, every day, the hundreds of steps of the two powerhouses, supervising every detail and speaking with coordinators, managers, and directors. In the most critical moments, such as during the fires, he never threw in the towel. He kept the team motivated, reminding everyone that they would be proud of Jirau once



Edson Silva and Victor Paranhos take part in the handover ceremony — an important moment that symbolizes the continuity of the work and the commitment to Jirau's objectives.

construction was completed. He was regarded with respect both by his colleagues in the office and by the workers on site.

Before the definitive change in the company's presidency, a two-month transition process was organized between the outgoing and incoming management teams. Edson Silva experienced moments of anxiety, alternating trips to Rondônia — to gain a close understanding of the reality of the project — with meetings at the Rio de Janeiro office, where he began structuring the first actions. **On November 21, 2019, he addressed Jirau's workers for the first time as president. He asked for everyone's collaboration and effort in this new chapter of the plant's history.**

— We are beginning a long journey together.

Shortly after taking office, Edson would face an unprecedented challenge — one that would surprise the world and cast doubt on what workplaces would look like from that point on. On March 11, 2020, the Director-General of the World Health Organization (WHO), Tedros Adhanom, declared that, given the rapid spread of the new coronavirus (SARS-CoV-2) — already present in 114 countries and with more than 120,000 people infected — the world was officially facing a pandemic.



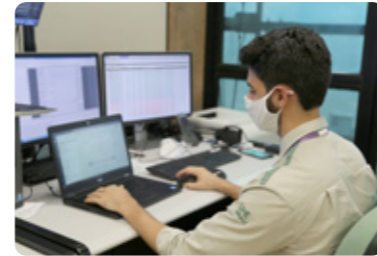
The company donated thousands of items — including surgical masks, gowns, gloves, and protective goggles — to the Municipal Health Department (Semusa) of Porto Velho to support the fight against the coronavirus. Supplies were also delivered to Indigenous territories and riverside communities, aiming to strengthen their response to the disease.



The news caught governments, companies, and society by surprise. Questions multiplied: how long would the outbreak last? How would it be controlled? For how long would social distancing need to be extended? What would the social and economic impacts be? Would remote work become the norm? The climate of uncertainty led authorities to adopt restrictive measures. **With millions of people confined at home — watching television, studying remotely, or joining virtual meetings — the electricity sector would become even more essential in everyday life.**

Transmission, distribution, and generation companies needed to keep their operations running at full capacity — which required a swift and coordinated response both at the administrative headquarters in Rio de Janeiro and at the plant facilities in Rondônia. Keeping a hydropower plant that supplies 40 million Brazilians in operation became even more critical, as did ensuring the safety and well-being of workers and their families.

The social-distancing measures imposed by many municipalities across the country emptied streets and offices. With only a few months in the role, Edson Silva found himself in a difficult moment: on many days, the Rio de Janeiro office was practically empty.



Employees undergo testing and work using masks and PPE.

“On some occasions, there were only three people in the office and a series of uncertainties ahead, with a single objective: to protect our employees and the plant’s operation,” he recalls.

Given the severity of the situation, Edson immediately called the executive board for an emergency meeting. During that meeting, a crisis committee was created, holding weekly meetings with leaders from all areas and the company’s medical team. Action plans, guidelines, and protection protocols were discussed there. Simulations were carried out for different scenarios, including the possibility of keeping operators isolated from their families should the pandemic worsen — a measure that, in the end, did not need to be implemented.

Several measures were implemented. Among them were the purchase of thousands of testing kits, the acquisition of millions of masks and liters of hand sanitizer for distribution to employees, and the adoption of strict distancing protocols. In the administrative sector, on-site staff was reduced, processes were digitized,

The cafeteria received new partitions, and an isolation area was set up in the powerhouse.



and videoconferencing was widely adopted in place of in-person meetings. The internal newspaper, previously printed, began to be distributed exclusively in digital format. Laptops, chairs, and footrests were made available so that teams could work remotely with proper ergonomics.

In the operations area — where physical presence was essential to keep the turbines running — a special arrangement was put in place. Work shifts, previously eight hours long, were extended to twelve hours, reducing the number of shift changes and minimizing exposure. Teams were reorganized, going from three to two per day. Dedicated vans for transportation between Nova Mutum Paraná and the plant were sanitized before and after each trip. In the cafeterias, acrylic dividers were installed between seats. In the maintenance area, movements were scheduled to avoid overlapping times or proximity between groups in the generating units. An isolation area was also created inside the powerhouse, prepared to accommodate workers in the event of more severe outbreaks.



Frequent temperature checks, vaccination, and information campaigns were all part of the pandemic strategy.

As the numbers of cases and deaths continued to rise, the company's occupational physician, Dr. Orlando Leite, began conducting live broadcasts directly from hospitals for employees and their families. The goal was to raise awareness about the severity of the pandemic, combat misinformation, and reinforce the importance of vaccination. 'It was a way to raise awareness at a time when fake news was spreading. We showed hospital beds, patients, interviewed doctors, and explained the warning signs everyone needed to watch for. That's how we were able to advance with vaccination,' the doctor recalls. To return to on-site work, presenting proof of vaccination was mandatory.

The company also carried out a specific assessment of employees' emotional well-being. A contingency plan was carefully prepared to address potential worsening scenarios, including the possibility of setting up a field hospital within the plant's premises should the state healthcare system collapse. Fortunately, this extreme measure was never needed. Jirau did not record any fatalities resulting from the pandemic. ■■■■

While the company focused its efforts on ensuring that the pandemic would not affect its employees or its operations, a milestone announcement was made on January 21, 2021: **Energia Sustentável do Brasil**, the concessionaire of the Jirau Hydropower Plant, unveiled its new identity. **Jirau Energia** was officially born.

The idea began to gain strength in the first months of the pandemic, when Edson noticed that social isolation and employees' fear amid the uncertainties surrounding the disease had caused discouragement among part of the team. In October 2020, the administrative office changed addresses in Rio de Janeiro, leaving the Almirante Barroso building and moving to Presidente Wilson.

The move brought a renewed atmosphere — and helped drive the creation of the corporate identity. The guiding principle was clear: do more with less. Instead of hiring a branding agency and investing millions, the solution was to use the We Do Logos platform, which allows companies to launch paid challenges for professional designers. With less than R\$ 20,000 in expenses, the company gained a new brand and began using social media to engage with the public.

More than just a visual change, the new brand reflected the maturity gained over the years — both in the business model and in the company's institutional positioning. It marked a turning point, signaling the transition from the construction and early-operation phase to a new cycle of consolidation and expansion. 'We have a history we are very proud of, and we understand that this



New Rio de Janeiro office after renovation, in October 2020.

is the ideal moment to reposition our brand,' he says. A name that represents our phase of full operation, with excellence, and our role as a reference in sustainable development in the Amazon," said Edson Silva, CEO of Jirau Energia.

The change coincided with an internal restructuring focused on the regulatory agenda. One of the main points of attention was the Transmission System Usage Tariff (TUST). In 2022, it was estimated that transmission charges accounted for about one-third of the plant's gross revenue. In addition to covering the costs of using the Basic Grid, this amount also contributed to ensuring affordable tariffs for consumers.

According to Jirau's concession notice, a pre-set tariff would be applied for ten years from the start of operations, after which it would be replaced by a new TUST calculated by Aneel — with the expectation that it would be lower. In 2013, the agency established a transition rule: the previous tariff would be partially maintained

The new strategic agenda culminated in the launch of the new corporate brand.



for two tariff cycles (two years), With the gradual application of the new values to soften the impact on revenue, the previous tariff would be phased out. After a lengthy administrative process, which included a public consultation, Aneel's board accepted Jirau Energia's request to remove this transition rule. **As of July 2022, the new TUST came into full effect, resulting in a reduction of approximately 30% in transmission charges.**

Another sensitive point in the regulatory environment was the Generation Scaling Factor (GSF), an indicator that measures the hydropower generation deficit. In a given year, the impact reached R\$ 12.2 billion for the sector due to the need for hydropower plants to purchase energy on the market during drought periods. Jirau Energia worked on two fronts to mitigate this risk.

The first front was institutional: the company actively participated in the discussions that led to the enactment of Law No. 14,120/2020, which recognized the impacts suffered by

hydropower generators between 2012 and 2020, such as delays in the construction of transmission lines for the Madeira Complex and Belo Monte, as well as thermal dispatch outside the merit order. Based on the legislation, in April 2022 Aneel approved Dispatch No. 921/2022, extending Jirau's concession by 847 days. Subsequently, the agency granted an additional 93 days to the already approved term, totaling an extension of two years and four months — now with expiration scheduled for December 2045. This extension contributed to restoring the project's economic and financial balance.

The second front was active commercial management. In 2021, faced with historically low inflows in the National Interconnected System (with the months from April to August showing the worst levels in 91 years), Jirau adopted a strategy to mitigate the impacts of the GSF, which closed the year at 73%. Taking advantage of moments when market prices dropped, the company carried out six energy auctions, including one for incentivized sources. Through this process, contracts were signed with 15-year terms starting in 2024, providing a structural hedge against the GSF at competitive prices. Purchases were also made for the second half and third quarter of 2021, as well as volumes for 2022, 2023, and 2024. This approach resulted in significant savings.

Internally, since 2019 there had been a continuous effort toward organizational improvement, strengthening leadership and refining processes. The goal was to reinforce a decentralized management philosophy, in which each manager and coordinator assumed direct responsibility for the budget, targets, and financial discipline of their area. Starting in 2021,

In 2021, amid a historic drought, Jirau adopted an active commercial management strategy to reduce hydrological risk.



Above, the new executive board, with Edson Silva (seated), Cynthia Thomé (right), Diego Collet (center), and Rodolfo Torres (left). At the top right, the leadership development program in 2025. Below, the arrival of Diego Collet to the Operations Board, following the departure of Isac Teixeira.



the Leaders' Forum began to take place at the beginning of each year, bringing together directors, managers, and coordinators to align objectives and discuss the company's main initiatives. In 2025, the organizational structure was once again adjusted: the former board that combined the finance and administration areas was split, giving rise to two new fronts — the finance board, led by Cynthia Thomé, and the institutional relations and administration board, headed by Rodolfo Torres.

Aligned with its commitment to local development, the company, in partnership with Senai, inaugurated in 2025 an advanced technical training center in Nova Mutum Paraná, occupying the former headquarters of the Science and Technology Center. The hub will serve more than 100 students per cycle in Electrotechnics technical courses, Electromechanics and



In partnership with Senai, the company inaugurated in 2025 an advanced technical training center with capacity to receive more than 100 students per cycle in Electrotechnics, Electromechanics, and Computer Operator technical courses.

professional training in Computer Operations. The first classes offered 35 seats each, filled after a selection process that attracted more than 700 applicants from the communities of Nova Mutum, Jaci-Paraná, and União Bandeirantes. The facility includes modern classrooms and areas dedicated to hands-on activities with specialized equipment.

In the Operations area, changes were implemented aimed at medium- and long-term planning for the project, seeking greater efficiency. Longer-term contracts were signed with strategic suppliers responsible for the operation and maintenance of mechanical and electrical equipment. The board also underwent adjustments, with the reinstatement of the engineering management area and the reorganization of the maintenance division.

To enhance operational excellence, several initiatives were carried out with a focus on cost reduction and process standardization. Regular meetings with senior management became routine, while investments in automation and modernization resulted in concrete gains. One example was the reduction of internal energy consumption

Aerial view of the former log boom, an important structure for turbine safety.



by an average of 4 MW, achieved through the upgrade of pumps and the reconfiguration of ventilation and cooling systems.

On a broader scale, the most prominent project was the renovation of the log boom, the floating barrier that prevents logs and debris from reaching the plant's turbines. The initiative became an example of the commitment and engagement of employees, even during a period marked by the uncertainties of the pandemic.

Upon taking over as president of Jirau, Edson Silva visited the area where the log boom system was being repaired — a critical component for protecting the generating units, composed of thousands of large floats designed to prevent logs from causing damage to the turbines. Still not generating operational profit, employees were making significant efforts to keep the system running in a space that resembled a large tire repair shop, with many fixes carried out manually. It was clear that the situation could not continue that way, but the pandemic imposed an immediate priority: protecting workers and their families.



On January 28, 2021, a partial rupture of the log boom occurred on the right bank of the river, requiring swift action. Three days later, on February 1, Diego Collet took over as Jirau's Operations Director, replacing Isac Teixeira. Having begun his career at ENGIE in 2003, Diego brought extensive experience in the operational management of the Itá and Machadinho hydropower plants in southern Brazil — facilities operated in consortium with other shareholders. His previous experience would prove valuable in facing the challenges he would encounter at Jirau.

The invitation to take on the position came informally, during a lunch at the seaside restaurant Zé do Cacupé, in Florianópolis, in January 2021. Upon stepping into the new role, Collet was immediately faced with a top priority: quickly finding a solution to the log boom issue, ensuring that the turbines could operate at full capacity. Edson Silva had also emphasized that the solution needed to be not only swift but sustainable, recalling the visit he had made to the area where repairs to the system were being carried out.

Without a sustainable solution, the financial impact would be inevitable. The existing structure, inspired by North American



One of Diego Collet's first challenges as Operations Director was to quickly find a solution to the log boom issue, which had suffered a partial rupture.

In the midst of the pandemic, the team's engagement and unity led to a competitive solution to the problem: the reuse of leftover materials from the plant's construction phase, which had until then been set aside.

dams, was nearing the end of its useful life and showed limitations when faced with the particular characteristics of the Madeira River — a fast-flowing watercourse, with strong currents and a high density of logs, branches, sediments, and macrophytes carried over long distances, from countries such as Peru and Bolivia.

In simple terms, the structure functions as the first barrier to prevent logs from compromising the performance of the turbines that generate electricity. And the force of the Madeira River was no technical exaggeration. Years earlier, during the plant's construction, board members had visited the site. José Ailton de Lima, then a director at Chesf and a Jirau board member, asked the Engineering Director, Maciel Paiva, about the real scale of the problem. Paiva took the group to a point on the dam and, timing one minute, began counting: 25 logs were spotted in 60 seconds — the equivalent of more than 30,000 logs per day.

The scene made clear the level of difficulty that would have to be faced. In the midst of the pandemic, the team's engagement and unity brought a competitive solution to the problem: the reuse of leftover materials from the plant's construction phase, which had until then been set aside. Among them were dozens of stop-log panels — metal structures used to seal the powerhouse — as well as barges and concrete and steel floats.

The civil maintenance team, supported by the companies Themag, Technomar, Sólido Engenharia, and Lumar, began studying solutions inspired by naval engineering, particularly systems used in offshore oil platforms and international breakwaters. The goal was twofold: to replace the old buoy system and to create a support mechanism for the mechanical claws operated by cranes,



Deployment of structures for anchoring the floats.



View of the log boom structure on the right bank (above) and on the left bank (beside).



which removed the logs accumulated around the structures. In critical periods, the buildup of wood reached six meters below the water level, posing a risk to turbine operation.

The solution developed involved deploying 50 floats and 38 anchoring structures, each weighing 200 tons, positioned precisely and safely on the riverbed. The repurposed stop logs were used to form a new containment line for the logs along the right bank of the Madeira River. In the second half of 2022, the new system went into operation, marking an important advancement in protecting the generating units on that bank.

With the success achieved, the next stage began installing a new system on the left bank as well. However, the repurposed materials had been exhausted, requiring a new approach. The team once again turned to concepts from naval engineering and breakwater design, developing a structure composed of 50 floats, each weighing 47 tons, forming an 800-meter-long line — a true floating wall on the horizon. The repositioning of the new log boom was defined based

on historical generation data dating back to 2013, identifying the most efficient channel to divert logs away from the dam.

In 2023, the company reached a historic milestone: 99.97% machine availability, which secured its 1st place in the national ranking of operational availability among hydropower plants in operation in Brazil.

The achievement was celebrated during the ten-year anniversary of the first turbine's commissioning, in two moments. On September 24, a concert by Jorge & Mateus was held at the Talismã 21 venue in Porto Velho. The following month, on October 25, the celebration took place at Jirau itself, in a ceremony that brought together former and current employees to mark the occasion.

Victor Paranhos returned to the plant and was one of the honorees. 'We started here in 2007, and there were many challenges, but we managed to make Jirau a reality. We had 25,000 people, 25,000 workers involved in the construction, and we



Among the events celebrating the ten-year anniversary, there was a concert by Jorge & Mateus at a music venue in Porto Velho.

generated more than 60,000 direct and indirect jobs. For me, it was a source of pride to see the Tiradentes School in Jaci-Paraná — which I often call the ‘School of Dreams’ — being built and, today, proving to be a success after so many years. We built schools, health posts, and carried out several other initiatives for social development,” said Paranhos.

The event was led by Edson Silva, CEO of Jirau Energia, who, after his speech, invited representatives of the shareholders to speak about this important moment: ‘I have been leading Jirau for four years, and along this journey I have discovered many things that drive us to seek creative solutions to continuously improve our company’s performance. I am deeply grateful for the support of the shareholders — ENGIE, Eletrobras, and Mitsui — especially for the invitation to take on this extremely challenging and rewarding mission. We continue to face many challenges, but we are confident that we will overcome them. Our trajectory of achievements, from construction to this operational phase, gives us that confidence,” he stated.



Victor Paranhos was one of the honorees at the ceremony marking ten years of Jirau’s operation, and the newly renovated auditorium was named after him.



With operational progress, the plant began generating enough revenue for new investments, which significantly increased the safety and internal logistical efficiency of the hydroelectric complex. Among these were the renovation of the control building and the auditorium, the construction of the Waste Management Complex, innovations in the fish passage system, and the implementation of the Clean Water project, in addition to paving the access roads and the roads over the dams — until then the only unpaved sections of the project.

“The first profit in 2023, after ten years of operation, is an important milestone, as it represents the company’s ability to adapt, overcome obstacles, and begin a new cycle of profit generation. As a result of the strategy to reduce market exposure — through energy-purchase auctions — and the tariff review of transmission charges, which led to a significant decrease in these costs, the company recorded a historic profit in 2024, which represented another important milestone in the company’s path toward growth and sustainability,” says João Henrique de Araújo Franklin Neto, who served as president of Chesf.



Eduardo Sattamini (in the first photo, on the left) became ENGIE's country manager in Brazil in April 2025, following an internal process that lasted nearly two years and aimed at an integrated transition and continuity of the previous management, led by Mauricio Bähr (on the right). In the second photo, representatives of Jirau gathered at the ceremony celebrating the 10 years of operation.



Executives from Axia (first photo) and representatives from Mitsui (second photo) at the plant's celebration event. In 2025, with the third consecutive year of positive net results, it was possible — using cash exceeding operational needs — to carry out a capital reduction of R\$ 750 million, fully distributed to the shareholders.

The operational turnaround brought further developments. In 2025, with the third consecutive year of positive net results, it became possible — using cash exceeding operational needs — to carry out a capital reduction of R\$ 750 million, fully distributed to the shareholders. The measure aimed to compensate for the extraordinary contributions previously made by them, during periods when additional resources were required to sustain the company's operations.

The transaction was preceded by a detailed economic and financial analysis conducted by all the banks involved in Jirau's financing (BNDES, Banco do Brasil, Caixa Econômica Federal, Bradesco, Itaú, and BNB) and was approved by Aneel. In this way, another important step was consolidated in the operational maturity achieved by Jirau Energia.

In parallel, also in September 2025, the corporate guarantees provided by the shareholders and linked to the financing agreement were released. This occurred after proof of compliance with the Financial Completion at the end of the 2024 fiscal year, which required two consecutive years of full debt-service payment, with a Debt Service Coverage Ratio (DSCR) above 1.2 — reaching 1.27 in 2023 and 1.37 in 2024 — and a Capitalization Ratio above 0.25 — reaching 0.44 in 2023 and 0.47 in 2024. This achievement symbolizes the company's structural turnaround, which enabled shareholders to regain the capacity to invest in new projects.

Another highlight of 2025 was the beginning of the use of the tax benefit granted by the Superintendence for the Development of the Amazon (Sudam), which consists of a 75% reduction in the Corporate Income Tax (IRPJ) levied on operating profit for ten

The implementation of effective practices for accident prevention and the promotion of well-being in the workplace led Jirau to obtain the international ISO 45001 certification.

years. Jirau obtained the renewal of this incentive in 2022, with validity ensured until 2031. Beginning to use it at this moment aligns with the company's strategic objectives, enhancing its financial efficiency through the significant tax savings generated.

In addition to the direct gain in tax efficiency, the benefit reinforces Jirau's institutional and social role in the Amazon, enabling the allocation of additional resources to programs supporting local communities through incentives such as the Elderly Statute, the Child and Adolescent Statute, the Lei do Bem, the Workers' Food Program (PAT), and other cultural and social development mechanisms. In parallel with the operational turnaround, Jirau Energia obtained ISO 45001 certification, an international recognition of the advances made in occupational health and safety management at the hydroelectric complex. The certification — the result of a rigorous audit process initiated in August 2022 — confirmed the implementation of effective practices for accident prevention and the promotion of well-being in the workplace.

ISO 45001 establishes requirements for the Occupational Health and Safety Management System (OHSMS), with a focus on risk identification, implementation of preventive controls, and continuous improvement. The achievement reflects the joint effort of leadership and employees — both direct and contracted — and symbolizes the strengthening of an organizational culture grounded in the preservation of life and the appreciation of people. More than merely complying with standards, the certification reflects the creation of an environment where safety is perceived and experienced on a daily basis.

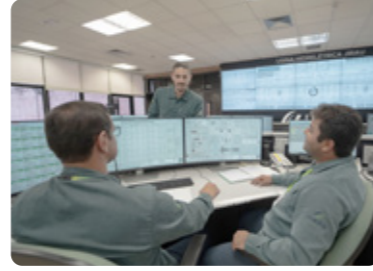
In addition to these advances in the area of safety, the plant's strategic capacity to supply the Northern region gained prominence during the severe drought of 2023 and 2024, which significantly affected the Amazon's hydrological regime.

Jirau, in addition to injecting energy into the National Interconnected System (SIN), also ensures regional supply through the back-to-back system installed at the Porto Velho Collector Substation, responsible for connecting the states of Acre and Rondônia.

Originally designed to allow the local operation of the Madeira River power plants — Jirau and Santo Antônio — when they were not dispatching energy to the rest of the country, the system became even more relevant with the drop in generation at Santo Antônio during the water crisis. The risk of supply disruption raised alerts throughout the region.

Given this scenario, Jirau Energia, together with the National Electric System Operator (ONS), began a series of studies and tests to assess the technical feasibility of operating the back-to-back system with only Jirau in operation. The results confirmed this possibility, providing the plant with greater operational flexibility. This adaptation was decisive in ensuring the energy security of Acre and Rondônia during the critical drought periods, when Santo Antônio was unable to activate its turbines.

Employee engagement has been strengthened through the improvement of talent attraction and retention policies. In October, for the second time in Jirau's history, a survey was conducted to assess employee satisfaction, and the results showed increases across all indicators compared with the 2023 assessment. The participation rate reached 99%. Engagement stood at 95%, two



Energy security was strengthened with the back-to-back system.

Priscilla Kretzmann, Jirau Energia's People and Culture Manager: the 2025 environment survey showed results better than those recorded in 2023 and above the average for the Brazilian job market.



percentage points higher than the result from two years earlier and six percentage points above the average for the Brazilian job market

Perceptions regarding career and development plans increased by 22 percentage points compared with the 2023 climate survey, and the retention rate rose by 14 percentage points. The company's operational turnaround in 2023 also made it possible to offer a profit-sharing program, reinforcing meritocracy and aligning strong individual performance with the company's overall results. ■■■



**Operation
90 quota**



On the morning of July 9, 2024, in Santa Cruz de la Sierra, Bolivia, Alexandre Silveira, Brazil’s Minister of Mines and Energy, and Franklin Molina Ortiz, Bolivia’s Minister of Hydrocarbons and Energy, signed a historic memorandum of understanding in the presence of the presidents of both countries, Luiz Inácio Lula da Silva and Luis Arce. The document strengthens bilateral energy integration, enables the optimization of the operation of the Jirau Hydropower Plant, increases its assured energy, and contributes to reducing diesel consumption in the neighboring country.

Signed by the governments of Brazil and Bolivia, the historic agreement enables the optimization of Jirau’s operation.



Edson Silva and Diego Collet celebrated the memorandum that will enhance the plant’s efficiency.

One of the main advances is the authorization to operate the plant while maintaining the reservoir level constant at up to 90 m during the dry season, which intensifies between June and October. The measure increases the hydropower plant’s efficiency by allowing greater flexibility in reservoir management, generating significant benefits for the National Interconnected System (SIN).

“We are establishing the general framework of strategic commitments for energy integration and complementarity between the two countries, with the aim of achieving greater utilization of energy resources — for the benefit of both — encompassing various activities in the energy sector, financing, technology transfer, and capacity building,” stated Minister Alexandre Silveira during the signing ceremony.





It was a long negotiation due to its complexity, but its conclusion is successful," said Rodrigo Limp, Vice President of Regulation at Axia Energia.

"It was a long negotiation due to its complexity, but its conclusion is successful and will enable more efficient operation of the plant at a time when hydropower generation is becoming increasingly important within a diversified energy matrix," said Rodrigo Limp, Vice President of Regulation at Axia Energia and board member of Jirau Energia, who closely followed the discussions at the Ministry of Mines and Energy and at Aneel between 2015 and 2022.

The origin of the restriction dates back to 2007, when, during the environmental licensing process for the Madeira Complex, Ibama and ANA established that the maximum elevation of 90 m could only be adopted during the flood season. During the dry season, the level had to be reduced to 82.5 meters in order to avoid impacts on the Bolivian banks of the Madeira River, whose basin is largely supplied by waters originating in Bolivian territory. Despite

The new agreement allows the plant to operate more efficiently during the dry season, maintaining the higher reservoir level for a longer period — which may represent an increase of up to 250 average MW in annual production.

its installed capacity of 3,750 MW, Jirau's effective generation fluctuates considerably throughout the year: the river's flow, which exceeds 40,000 m³/s during the flood season, can drop to less than 5,000 m³/s in the dry season, which limits generation.

As a result, Jirau's assured energy was set at 2,184 average MW, based on the performance of its 50 bulb turbines. The new agreement allows the plant to operate more efficiently during the dry season, maintaining the higher reservoir level for a longer period — which may represent an increase of up to 250 average MW in annual production. **This gain strengthens energy security in the states of Acre and Rondônia and reduces the need to purchase energy on the short-term market, helping to mitigate hydrological risk.**

Operating the reservoir at 90 m above sea level also brings direct benefits to river navigation on the Madeira River, especially during the driest months, as has occurred in recent years. The agreement also provides for the construction of four water-monitoring stations in Bolivian territory, which will allow for greater accuracy in tracking the inflows that reach the turbines. The optimized operation of the plant increases the revenue from the Financial Compensation for the Use of Water Resources (CFURH) for Porto Velho, the state of Rondônia, and the federal government.

The positive impacts also extend to Bolivia. Today, the northern region of the country depends largely on diesel-fired thermoelectric plants, which entail high operating costs, significant pollutant emissions, and complex logistics involving the annual transport of more than 50 million liters of fuel. Fluctuations in oil prices, intensified by the war between Russia and Ukraine, increased Bolivia's

interest in the agreement starting in 2022.

In February 2023, in Rio de Janeiro, Manuel Valle Vargas, then president of Bolivia's National Electricity Company, met with Edson Silva of Jirau Energia to discuss the feasibility of supplying cleaner and more affordable energy. **With the new operational model, part of the Brazilian company's generation will be directed to the neighboring country, reducing costs and contributing to the decarbonization of its energy matrix.**

As a direct consequence of the bilateral memorandum, ANA's collegiate board approved, in October 2024, a new water-use concession for Jirau, updating the terms established since 2007. Previously, the plant was required to operate based on the guide curve, which set seasonal limits for raising the reservoir level in order to preserve the river's marginal strip on the Bolivian side. The new regulatory decision allows the plant to operate with a small seasonal reservoir, maintaining the 90-meter level for a longer period and thus increasing the energy output of the generating units during the dry season.

The implementation of the new regime will take place in two phases due to the presence of a riverside recreation area in the district of Fortaleza do Abunã, about 300 km from Porto Velho. The river beaches that form between August and October are traditionally frequented by residents and tourists, with high visitation during the September 7 holiday. In respect for this local dynamic, since 2025 the operation at the 90-meter level has been gradually expanded by maintaining the river level at the beginning of the dry season and scheduling its reduction in time for the formation of the beaches, followed by a faster rise in the reservoir level at the onset

As a direct consequence of the bilateral memorandum, ANA's collegiate board approved, in October 2024, a new water-use concession for Jirau, updating the terms established since 2007.

The agreement will enable a new financial moment for the project," said Chief Financial Officer Cynthia Thomé.



of the rainy season. Under this model, the expected energy gain is 120 average MW. "This will enable a new financial moment for the project," said Chief Financial Officer Cynthia Thomé.

The bilateral agreement establishes that two-thirds of the additional energy will remain with Jirau — responsible for generation and the necessary investments — while the remaining one-third will be allocated to Bolivia. To enable the commercialization of its share, the neighboring country created an energy trading company in Brazil, which has initially been operating in the free market until the cross-border transmission system capable of physically delivering the energy to Bolivian territory is completed. Once this interconnection is in place, the priority will be to supply Bolivian communities near the border with Rondônia and Acre, which currently depend on isolated systems powered by fossil fuels. The measurement and allocation of the additional energy will be handled by the Electric Energy Trading Chamber (CCEE). To formally make this additional energy available, Jirau Energia has

already requested that Aneel revise its assured energy, currently set at 2,101.5 average MW.

“The historic agreement signed between the two countries in 2024 crowned a long trajectory that spanned several presidents and ministers,” said Carlos França, Brazil’s Minister of Foreign Affairs from 2021 to 2022, who served for 12 consecutive years, from 1999 to 2011, in diplomatic posts in Washington, Asunción and, twice, in La Paz, where he was deputy chief of mission and headed the energy sector of the embassy.

Debates on energy integration date back to earlier periods. In 2014 and 2015, during the Dilma Rousseff administration — when the Southeast faced a severe drought and the reservoirs, responsible for 70% of the country’s hydroelectric supply, fell below 30% — Brazil sought an agreement with Bolivia. In February 2016, Eduardo Braga and Luis Alberto Sánchez, then the Brazilian and Bolivian Ministers of Mines and Energy, respectively, signed, at the Itamaraty Palace, a work agenda for the Brazil–Bolivia Binational Technical Committee on Energy Matters.

The document consolidated the negotiations held on January 27 and 28, 2016, in Santa Cruz de la Sierra, during which new steps to deepen energy cooperation between the two countries were discussed. One of the agreed-upon topics was the development of a schedule to allow Jirau to operate at a constant elevation of 90 meters, as well as the preparation of pre-feasibility and feasibility studies for the binational hydroelectric development of the Madeira River and Cachuela Esperanza. It was also established that Bolivia would conduct studies for two national hydroelectric plants on the Beni River (Bala) and the Grande

“The historic agreement signed between the two countries in 2024 crowned a long trajectory that spanned several presidents and ministers,” recalls Carlos França, former Minister of Foreign Affairs of Brazil.

In 2016, Eduardo Braga and Luis Alberto Sánchez, then the Brazilian and Bolivian Ministers of Mines and Energy, respectively, signed a work agenda for the Brazil–Bolivia Binational Technical Committee on Energy Matters.



River (Rositas), with the possibility of Brazilian participation should the projects advance.

In 2018, during the Michel Temer administration, the topic returned to the agenda. On July 5, Brazilian and Bolivian technical teams met in Santa Cruz de la Sierra, within the Brazil–Bolivia Bilateral Technical Committee, to define more in-depth studies on legal and regulatory frameworks that would need to be created or adapted to enable proposals such as Jirau’s new operational level. In 2021, under President Jair Bolsonaro, after Brazil faced one of the most severe droughts in its history, discussions resumed once again. A major lesson from that period was the need for studies and monitoring and mitigation programs to be proposed by the concessionaire to environmental authorities in both Brazil and Bolivia.

The outcome came in 2024 with the signing of the memorandum mentioned at the beginning of this chapter, which sealed the understanding between Presidents Luiz Inácio Lula da Silva and Luis Arce, consolidating a decade and a half of technical and diplomatic negotiations and inaugurating a new phase of bilateral energy cooperation. Since then, progress has been significant.

MEMORANDO DE ENTENDIMENTO ENTRE O MINISTÉRIO DE MINAS E ENERGIA DA REPÚBLICA FEDERATIVA DO BRASIL E O MINISTÉRIO DE HIDROCARBONETOS E ENERGIAS DO ESTADO PLURINACIONAL DA BOLÍVIA SOBRE A MODIFICAÇÃO DA OPERAÇÃO DA USINA HIDRELÉTRICA DE JIRAU EM COTA 90 M

O Ministério de Minas e Energia do Governo da República Federativa do Brasil e o Ministério de Hidrocarbonetos e Energias do Governo do Estado Plurinacional da Bolívia, doravante denominados “Participes”;

Considerando o firme propósito de promover a integração entre os países da América do Sul;

Tendo presentes os compromissos estabelecidos no Memorando de Entendimento entre a República Federativa do Brasil e o Estado Plurinacional da Bolívia sobre o Desenvolvimento de Intercâmbios Elétricos e Futura Integração Elétrica, de 30 de março de 1998; no Memorando de Entendimento em Matéria Energética entre o Ministério de Minas e Energia da República Federativa do Brasil e o Ministério de Hidrocarbonetos e Energia do Estado Plurinacional da Bolívia, de 17 de dezembro de 2007; e no Termo Aditivo ao Memorando de Entendimento em Matéria Energética entre o Ministério de Minas e Energia da República Federativa do Brasil e o Ministério de Hidrocarbonetos e Energia do Estado Plurinacional da Bolívia, de 16 de julho de 2015;

Amparados no “Convênio para a Preservação, Conservação e Fiscalização dos Recursos Naturais nas Áreas de Fronteira entre o Governo da República Federativa do Brasil e o Governo da República da Bolívia”, de 15 de agosto de 1990 e no Tratado de Cooperação Amazônica (TCA);

Reafirmando os termos do “Acordo de Complementação Econômica entre os Governos dos Estados Partes do Mercosul e o Governo da República da Bolívia”, celebrado em 17 de dezembro de 1996, que tem entre seus objetivos promover a complementação e a cooperação econômica e energética entre os países;

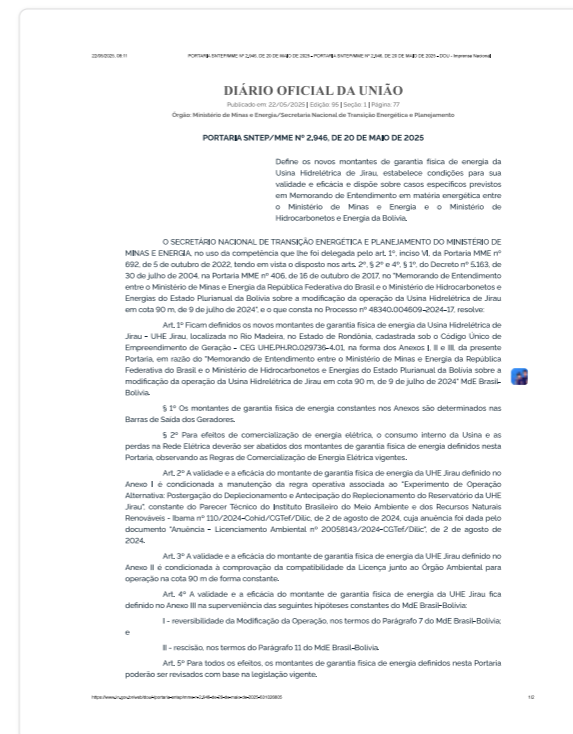
Considerando que nos termos do Memorando de Entendimento, o Comitê Técnico Binacional deverá avaliar as oportunidades e projetos de aproveitamento dos recursos hídricos em benefício de ambos os Participes de maneira racional, eficiente, sustentável e durável.

Reconhecendo os estudos promovidos no âmbito do Comitê Técnico Binacional Brasil-Bolívia (CTB), que analisaram os benefícios potenciais da operação da Usina Hidrelétrica de Jirau (doravante UHE Jirau) em Cota 90 m (nível de montante), e que antecipam benefícios energéticos e vantagens para a navegação e a operação da cascata do Rio Madeira;

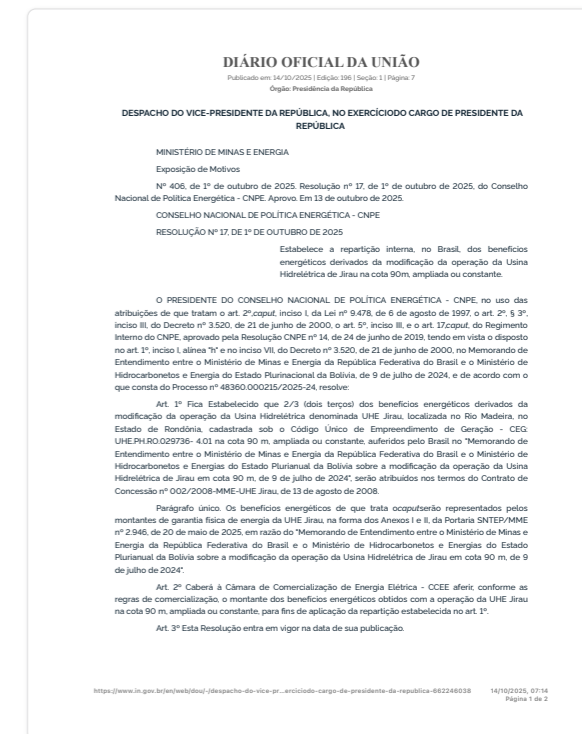
Em consonância com as leis e regulamentos vigentes nos respectivos países, os Participes acordam:

PARÁGRAFO 1º OBJETO

O presente Memorando de Entendimento, doravante “MdE”, tem por objeto acordar a modificação da operação da UHE Jirau em Cota 90 metros, constante ou ampliada, com vistas a auferir benefícios



In May 2025, EPE announced the extraordinary revision of the plant’s assured energy for both phases: operation at a constant 90-meter level and operation at the expanded 90-meter level.



In April 2025, Jirau Energia held a meeting with Ibama to discuss constant-level operation and the measures required to obtain the environmental license under the new parameters. The studies are underway, and the expectation is that Ibama’s assessment will take place in 2026, so that any necessary mitigation works can be carried out in 2027, allowing full operation at the 90-meter level beginning in 2028.

In May 2025, through Ordinance SNTep/MME No. 2,946, the Energy Research Office (EPE) announced the extraordinary revision of the plant’s assured energy for both phases — operation at a constant 90-meter level and operation at the expanded 90-meter level — incorporating the agreement to optimize the plant’s operation at the 90-meter elevation.



The release of hatchlings of the yellow-spotted river turtle (*Podocnemis unifilis*) and the Amazon river turtle (*Podocnemis expansa*) in the Bolivian municipality of Nueva Esperanza is part of the Monitoring Program for Operation at the 90-meter level and is aligned with the Memorandum of Understanding signed in 2024.

After this expanded phase, Jirau will need to obtain a new environmental license and rely on the full validity of the memorandum signed with Bolivia to operate permanently at the 90-meter level. Once completed, the update will add 236 average MW to the plant's generation — an amount equivalent to building a new 500-MW hydroelectric facility.

The optimized operation will also result in the sharing of additional energy, ensuring revenue for Bolivia, which will receive one-third of the benefit. To move forward with constant operation at the 90-meter level, on December 9, in Cochabamba, Jirau's executives met with the new leadership of the National Electricity Distribution Company (ENDE), now headed by Mario Larrain Saavedra, and on that occasion, they outlined the work agenda for the coming months.

The optimized operation also represents a leap in Jirau's power-generation efficiency and enhances its strategic flexibility, both from an energy standpoint and for the management of the Madeira River's waters.



On September 3, 2024, Jirau Energia and ENDE signed the agreement (above). A little over a year later, the boards of the two companies met again in Cochabamba to discuss the work agenda.

“We are preparing to become even better in the future,” says Edson Silva. “Jirau is in continuous evolution, and there will be other chapters in this story of success and resilience from the very beginning, always striving to move forward and create value for Brazil,” adds Mauricio Bähr.

Interviewees



Ana Arruda
President of the Women Association of Nova Mutum Paraná (Asmunomu), she is one of the leaders of the resettled community of the former Mutum-Paraná.



André Barretto
Regulation and Commercialization Manager at Jirau Energia since June 2012.



Antonio Luiz Abreu Jorge
Executive director of the consultancy Estratégia e Inovação Socioambiental (Eisa) since 2014. He served as Sustainability Director at Jirau Energia from 2008 to 2013 and as Sustainability Manager for the group from 2000 to 2007.



Antonio Miguel Marques
President of the Camargo Corrêa Group from 2007 to 2011, he joined the company in 2005 as president of Camargo Corrêa Cimentos. He served as president of GRU Airport between 2012 and 2015.



Breno Carvalho
Engineering, Planning and Performance Manager since 2024, he has been involved in the Jirau Project since 2009.



Carla Carvalho
Legal director of the Energia Sustentável do Brasil (ESBR) consortium from 2007 to 2010.



Carla Primavera
Superintendent of the Energy Transition and Climate Division at BNDES. She has worked at the Bank since 2000 and currently leads the teams responsible for structuring financing for projects in the energy sector (power generation, transmission, distribution, energy efficiency, new energy technologies and natural gas), in addition to representing the division institutionally before public and private entities.



Carlos França
A career diplomat, he served at the Brazilian embassies in Washington, Asunción and La Paz between 1999 and 2011, and was Minister of Foreign Affairs from 2021 to 2022. Since 2023, he has been Brazil's ambassador to Canada.



Christiany Salgado Faria
 Director of Planning and Power Generation Permits at the National Secretariat for Energy Transition and Planning of the Ministry of Mines and Energy (MME).



Cynthia Thomé
 Chief Financial Officer of Jirau since June 2025, she previously served as Latin America Controllership Manager at ENGIE from March 2022 to May 2025.



Diego Collet
 Operations Director at Jirau Energia since 2021, he joined ENGIE in 2003.



Dirk Beeuwsaert
 A member of the Board of Directors and of the Strategic Committee of ENGIE Brasil Energia, he has been with the group since 2000. He was CEO of GDF Suez Energy International and president of GDF Suez Energy in North America.



Dona Ana (Ubirany Moreira Rios)
 Owner of the main hotel in Nova Mutum Paraná and a community leader.



Édio Luz
 Senior consultant to the Energia Sustentável do Brasil consortium from 2007 to 2018.



Eduardo Sattamini
 CEO of ENGIE Brasil since April 2025, where he began his career in 2000, he also serves as CEO of ENGIE Brasil Energia since July and as Executive Director for Renewables and Batteries at ENGIE Latam. He is also a member of the Board of Directors of Itá Energética, TAG and Jirau Energia.



Edvaldo Santana
 Superintendent of Economic and Market Studies at Aneel from 2000 to 2005 and director of Aneel from 2005 to 2013. He was Vice President of New Business at Electra Energy from 2018 to 2020 and CEO of the Association of Large Energy Consumers from 2016 to 2018.



Elisangela Oliveira
 Executive assistant to the CEO of Jirau Energia since 2010.



Fabio Alves
 Board member of Jirau Energia from 2018 to 2023. He served as Secretary of Electric Power at the Ministry of Mines and Energy from 2016 to 2018 and was president of Eletrobras Chesf (now Axia Energia) from 2018 to 2023.



Flavio Campos
 At Leme Engenharia since 1976, he became the company's CEO in 1994.



Felipe Batista
 Legal director of Jirau Energia from 2009 to 2016. He is currently the legal and ethics director at ENGIE Brasil.



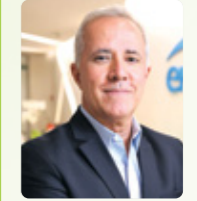
Fernando Coelho Filho
 Brazil's Minister of Mines and Energy at the time of the plant's inauguration. He is a federal congressman representing the state of Pernambuco.



Francisco Lima Ferreira
 Principal of the Nossa Senhora de Nazaré School, the municipal school of Nova Mutum Paraná, and a resettled resident from the former Mutum-Paraná.



Gerard Mestrallet
 CEO and chairman of the Board of Directors of Suez starting in 2001. He also chaired the Board of Directors of GDF Suez from July 2008 to May 2016 and that of ENGIE from 2016 to May 2018. He currently serves as the French government's special envoy for the India-Middle East-Europe Economic Corridor.



Gil Maranhão Neto
 Special advisor to the CEO of ENGIE in Brazil, he joined the group in 1996 as delegated manager for Brazil. During the development and implementation of Jirau, he served as ENGIE Brasil's Director of Business Development and Sustainability.



Guilherme Azevedo
 A member of the Board of Directors of Jirau, he is ENGIE's Vice President of Finance for Renewables and Business Control Director for South America.



Gustavo Labanca

Project and Business Development Manager at ENGIE from 1998 to 2019. He is currently ENGIE Brazil's Energy Transmission Director, an alternate member of the Board of Directors of ENGIE Brasil Energia, and a full member of the Board of TAG, where he served as CEO from June 2019 to March 2025.



Helvio Guerra

Chairman of Aneel's Special Bidding Commission (CEL) from 2006 to 2010, responsible for energy and transmission line auctions. He served as Deputy Secretary for Energy Planning and Development at the Ministry of Mines and Energy from 2019 to 2020 and as a director of Aneel from 2020 to 2024.



Isac Teixeira

Operations Director of Jirau Energia from 2011 to 2021.



Jacintho Alvares

Director at Leme Engenharia and responsible for supervising the construction works from 2008 to 2016.



Jaime Melo

Maintenance Manager at Jirau Energia since 2024, he has been involved in the project since 2010.



Jean-Pierre Clamadieu

Global Chairman of the Board of Directors of ENGIE since 2018, he was CEO of Rhodia from 2003 to 2012 and of Solvay from 2012 to 2019.



Jerson Kelman

President of the National Water Agency (ANA) from 2000 to 2005. He later became Director-General of the National Electric Energy Agency (Aneel) from 2005 to 2008 and served as CEO of Light and Sabesp. He is currently a board member of several companies.



João Henrique de Araújo Franklin Neto

Chairman of the Board of the Brazilian Association of Electric Power Transmission Companies (Abrate) and Vice President of the Brazilian Association of Electric Power Generation Companies (Abrage). Since 2023, he has been the president of Eletrobras Chesf (now Axia Energia), after holding several managerial positions in the company's operations and regulatory areas.



José Ailton de Lima

He worked for 40 years at Chesf, serving as Engineering and Construction Director for 12 of those years. He was also a board member of Jirau Energia.



Joisa Dutra

Director of the Brazilian Electricity Regulatory Agency (Aneel) from 2005 to 2009. Since 2010, she has headed the Center for Regulation in Infrastructure (FGV CERI).



Jonatha Souza

Operations Technician at Jirau Energia since 2014 and a resettled resident from the former Mutum-Paraná.



Jorge Vianna

Governor of the state of Acre from 1999 to 2006 and senator from 2011 to 2019, having served as First Vice President of the Senate in 2013. In the Senate, he was the rapporteur for the New Forest Code, the New Biodiversity Access Law, and the Science, Technology and Innovation Code. Since 2023, he has been the president of Apex Brasil.



Juliana Lessa

Contracts Manager at Jirau Energia from 2008 to 2015.



Julio Freitas

Administrative Director of Jirau Energia from 2017 to 2025 and Financial Director from 2021 to 2025.



Koichi Katayama

Board member of Jirau Energia. He has worked at Mitsui since 1995, involved in thermal and renewable energy projects in various leadership positions.



Luiz Eduardo Barata

President of the National Front of Energy Consumers and of the Institute of Energy Consumers (Icen). He previously served as Director-General of the National System Operator (ONS), Executive Secretary of the Ministry of Mines and Energy, and Chairman of the Board of the Electric Energy Trading Chamber (CCEE).



Maciel Paiva
Engineering Director of Jirau Energia from 2009 to 2015. He currently serves as an advisor to the municipal government of Itabira (MG).



Manoel Zaroni
Member of the Board of Directors of Jirau Energia. He served as director and CEO of Tractebel Energia from 1999 to 2016. He previously worked at Furnas from 1973 to 1998.



Marc Claassen
Manager at TAG. He took part in the evaluation of Gerasul in 1998 and joined ENGIE in 2010, working in the financial area.



Marcelo Fonseca
Operations Manager at Jirau Energia since 2018. He has been involved in the project since 2012.



Marcelo Thomé
President of the Federation of Industries of the State of Rondônia.



Marcio Giannotti
Internal Audit Manager at TAG, where he has worked since 2019. He previously worked at Jirau Energia from 2010 to 2019, serving as logistics coordinator and later as Procurement and Internal Audit Manager.



Márcio Zimmermann
Minister of Mines and Energy from 2005 to 2011. He served as Executive Secretary and held other positions within the ministry between 2011 and 2015. He is currently the president of Amazonas Energia.



Maria de Nazaré Meneses do Nascimento
Resettled resident from the former Mutum-Paraná.



Marisete Pereira
Superintendent of the Economic and Financial Department at Eletrosul from 1987 to 2005. She worked at the Ministry of Mines and Energy from 2005 to 2022, serving as Executive Secretary from 2019 to 2022. She is president of the Brazilian Association of Electric Power Generation Companies and a member of the Board of Directors of Jirau Energia.



Matheus Amorim
Member of ENGIE's first trainee class. He worked in ENGIE's Business Development area from 2007 to 2016, including on the Jirau project.



Mauricio Bähr
Chairman of the Board of Directors of Jirau Energia since the formation of the consortium that participated in the auction in 2008. He has been with ENGIE since 1997, where he served as head of the Group's renewable energy division in Latin America until April 2025. He was Chairman of the Board of the National System Operator (ONS). He is also chairman of the boards of ENGIE Brasil Energia and TAG.



Maurício Tolmasquim
Executive Secretary of the Ministry of Mines and Energy from 2003 to 2004, where he coordinated the development of the new regulatory model for the electricity sector. President of the Energy Research Company (EPE) until 2016. Board member of Axia Energia.



Michel Obara
Environmental and Socioeconomic Manager at Jirau Energia since 2025. He has been involved in the project since 2015.



Nelson Hubner
Minister of Mines and Energy and former Executive Secretary of the ministry. He served as Director-General of the Brazilian Electricity Regulatory Agency (Aneel) in 2009. He was a member of the Boards of Directors of Eletronuclear, Eletrobras, and Cemig, and also served as Chairman of the Board of Light.



Nilcy Martins
People and Culture Manager at Jirau Energia from 2015 to 2024.



Orlando Leite
Occupational Physician, working at Jirau since 2008.



Tenente-coronel Ossuci
Principal of the Tiradentes Military Police School, inaugurated on February 8, 2014, serving from 2013 (when it was still the 'School of Dreams') to 2019.



Paula Barcellos

Member of the legal department at Jirau Energia from June 2008 to 2021, where she also served as Director of Legal Affairs and Ethics.



Paulo Almirante

Chief Executive Officer of the Generation Business Unit in Europe and Vice President of ENGIE's Executive Committee. He is also Vice Chairman of the Board of Directors of ENGIE Brasil Energia.



Paulo Mantuano

Financial Manager at ENGIE from 1998 to 2009 and Chief Financial Officer of ESBR from 2009 to 2018. He is currently a fiscal council member at TAG.



Priscilla Kretzmann

People & Culture, HSE, and Communications Manager since June 2024; she joined ENGIE in 2019.



Richard Dumas

Chief Financial Officer of ENGIE Brasil from February 2020 to January 2024. With the Group since 2000, he has held various positions in several countries.



Rodolfo Torres

Administrative and Institutional Relations Director at Jirau since June 2025. He has been with the company since 2021.



Rodrigo Limp Nascimento

Vice President of Regulation and Institutional Relations at Axia Energia, where he served as President from May 2021 to September 2022, and board member of Jirau Energia. He was a director at Aneel and Secretary of Electric Energy at the Ministry of Mines and Energy.



Ronaldo Custodio

Worked for 33 years at Eletrosul, including more than 13 years as a director of the company (now Axia Energia), overseeing the Engineering and Operations areas and also serving as President.



Thais Ferraz Soares

The first employee hired by Jirau Energia, she worked at the company from 2008 to 2018. She has been Sustainability Director at ENGIE Brasil since October 2025.



Thiago Fonseca

Quality and Risk Management Manager at Jirau Energia, with previous experience in the Maintenance Planning and Contracts areas. He has been involved in the project since 2013.



Veríssimo Neto

Environmental and Socioeconomic Manager at Jirau Energia from 2013 to 2025, currently Project Manager at the company.



Verônica Sánchez da Cruz Rios

Director-General of the National Water Agency (ANA). A federal public servant since 2009, she worked in the Chief of Staff's Office on the planning and monitoring of electricity generation and transmission initiatives included in the PAC.



Victor Paranhos

First President of Gerasul after the company's privatization. He led the construction of the Cana Brava, São Salvador, Estreito, and Jirau hydropower plants. He served as President of Jirau Energia from 2008 to 2019.



Wagner Angelico Leite

Health and Safety Manager at Jirau Energia from 2021 to 2023. He is currently part of ENGIE in Chile.



Wilson Ferreira Jr.

He served as President of Rio Grande Energia from 1998 to 2000, CPFL Paulista from 2000 to 2002, and CPFL Energia from 2002 to 2016. He was Chief Executive Officer of Eletrobras (now Axia Energia) from 2016 to 2021. He is Chairman of the Board of Directors of Matrix Energia.

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For the preparation of this work, the archives of the magazines CartaCapital, Época, IstoÉ, and Veja were consulted, as well as the newspapers Folha de S.Paulo, Gazeta Mercantil, Jornal do Brasil, O Estado de S. Paulo, O Globo, and Valor Econômico.

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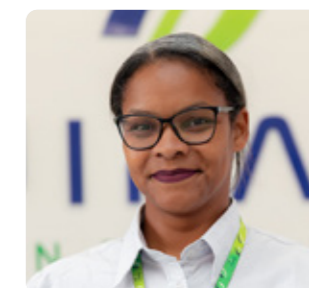
He is a journalist and writer. Coauthor of *Short Circuit: When Brazil Almost Went Dark*, organizer of the book celebrating 20 years of the free electricity market in Brazil, published by CCEE, and author of *ENGIE: 25 Years of History in Brazil*.

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Chief Executive Officer of Jirau Energia, responsible for the hydropower plant and a member of ENGIE's Executive Committee in Brazil. He joined ENGIE in 2000, taking on the role of Head of the Regulatory Affairs and Markets Department at ENGIE Brasil Energia. He later became Director of Strategy and Regulation at ENGIE Brasil Energia, leading the areas of Regulation, Energy Management, Information Technology, Strategy, and Innovation. He served as Chairman of the Board of the Brazilian Association of Independent Power Producers (Apine). Before joining ENGIE, he worked as a professor and consultant in the energy sector.



DAIANA COSTA

She is a journalist and a specialist in Communication Management and Strategic Planning. She currently serves as Communications Coordinator at Jirau Energia, having joined the company during the construction of the power plant.

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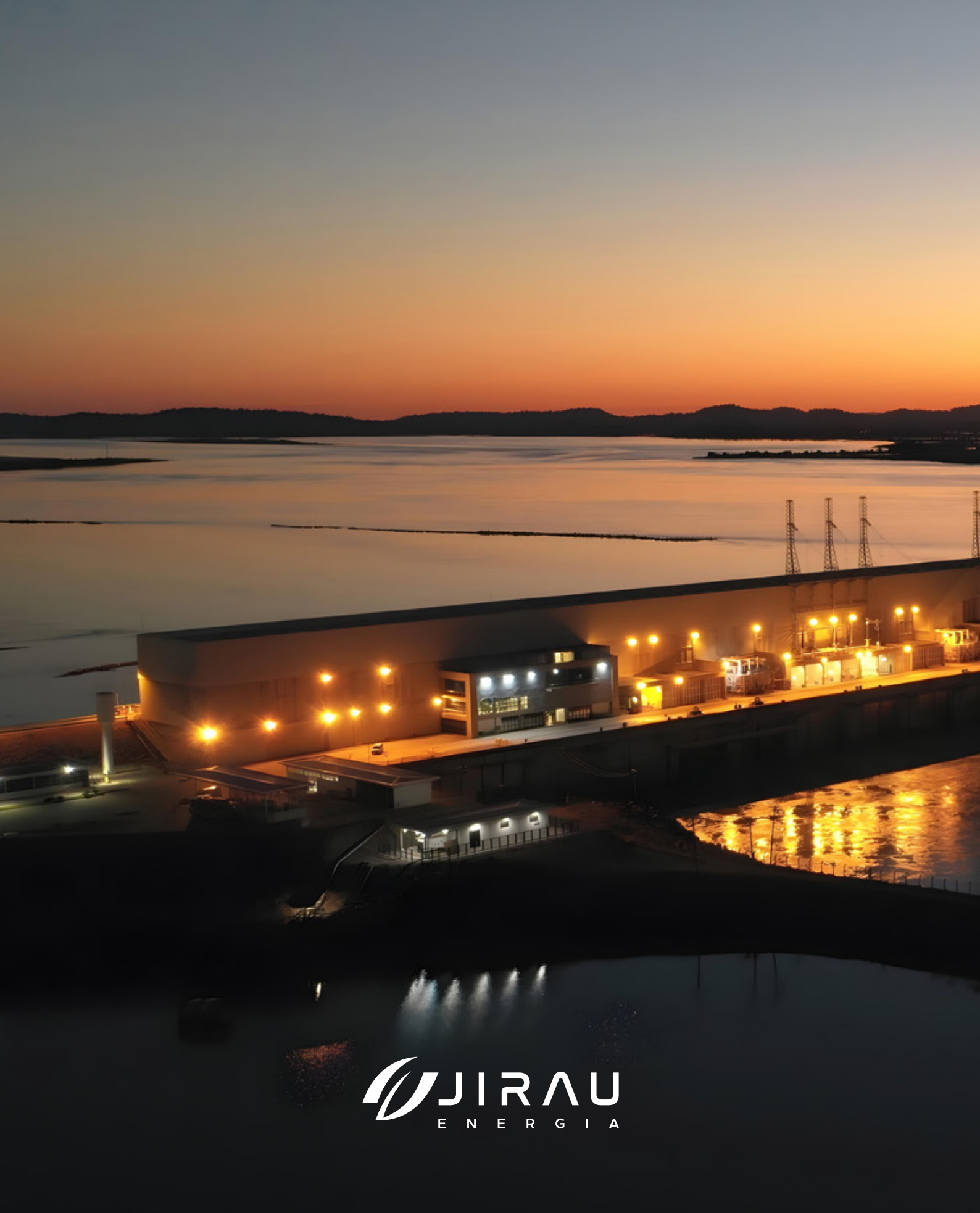
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Rodovia BR 364, km 824, s/nº
Distrito de Jaci-Paraná – Porto Velho (RO)
CEP: 76840-000
www.jirauenergia.com.br

ISBN: 978-65-978880-2-3



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