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*RENEWABLE ENERGY IN THE AMAZON: COMPANIES THAT INVEST AND
CHALLENGES OF IMPLEMENTATION¹*

**ENERGIA RENOVÁVEL NA AMAZÔNIA: EMPRESAS QUE INVESTEM E
DESAFIOS DE IMPLEMENTAÇÃO**

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ABSTRACT

The study analyzed the performance of companies listed on B3 that operate in the renewable energy sector in the Amazon, with the aim of assessing the progress of these companies in implementing clean energy and their economic viability. Nine companies in the electric power segment focused on generation, distribution and transmission in the Amazon region were identified. Financial and operational data were collected over 20 years. Using data from annual reports and financial statements, the research revealed consistent growth of these companies, despite some fluctuations. The results indicate that, despite the fluctuations, these companies demonstrated consistent growth, highlighting the significant potential of the Amazon for renewable energy, such as solar and hydroelectric, although implementation faces challenges related to initial costs, infrastructure and lack of data on other renewable sources, such as wind and biomass. The growing interest in sustainable practices has driven investment, and companies in the clean energy sector that stand out in the Corporate Sustainability Index (ISE) have the opportunity to attract investors interested in supporting sustainable initiatives and improving their corporate image. Investing in renewable energy in the Amazon brings significant benefits and aligns with the UN's global goals.

Keywords: clean energy, investments, energy matrix.

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RELISE

258

RESUMO

O estudo analisou a atuação de empresas cotadas na B3 que operam no setor de energias renováveis na Amazônia, com o objetivo de avaliar a evolução dessas empresas na implementação de energias limpas e sua viabilidade econômica. Foram identificadas nove empresas do segmento de energia elétrica focadas em geração, distribuição e transmissão na região amazônica. Dados financeiros e operacionais foram coletados ao longo de 20 anos. Utilizando dados de relatórios anuais e demonstrações financeiras, a pesquisa revelou um crescimento consistente dessas empresas, apesar de algumas flutuações. Os resultados indicam que, apesar de flutuações, essas empresas demonstraram crescimento consistente, evidenciando o potencial significativo da Amazônia para energias renováveis, como solar e hidrelétrica, embora a implementação enfrente desafios relacionados a custos iniciais, infraestrutura e falta de dados sobre outras fontes renováveis, como eólica e biomassa. O interesse crescente em práticas sustentáveis tem impulsionado investimentos, e as empresas do setor de energia limpa que se destacam no Índice de Sustentabilidade Empresarial (ISE) têm a oportunidade de atrair investidores interessados em apoiar iniciativas sustentáveis e melhorar sua imagem corporativa. Investir em energias renováveis na Amazônia traz benefícios significativos e alinha-se com as metas globais da ONU.

Palavras-chave: energia limpa, investimentos, matriz energética.



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259

INTRODUCTION

The Amazon, the largest biome in the world, extends across nine countries and covers a vast area of 4,196,943 km², encompassing approximately 49.29% of Brazilian territory (BRASIL, 2021). This biome plays a fundamental role in global climate regulation and in maintaining biodiversity, standing out as a vital repository of ecological services (WWF Brazil, 2024). The relevance of the Amazon in the context of climate change has been widely recognized, especially in light of UN warnings about the urgent need to limit the increase in global temperature to less than 1.5°C above pre-industrial levels. If countries do not take action, the world will face catastrophic changes (STYLIANOU et al., 2019).

Growing concern over global warming, whose main cause is the emission of greenhouse gases, has placed the Amazon at the center of discussions on climate change mitigation (BARROSO; MELLO, 2020). The planet is now nearly one degree warmer than it was before industrialization, according to the Intergovernmental Panel on Climate Change (IPCC, 2018).

According to the International Energy Agency (IEA, 2024), energy production — which includes the generation of electricity and heat, primarily originating from the burning of fossil fuels — is one of the largest sources of CO₂ emissions worldwide. For this reason, renewable energy sources are becoming increasingly important as countries seek to reduce their CO₂ emissions.

Brazil has a highly renewable electricity matrix, with 82% of its composition divided among hydroelectric, solar, wind, and other renewable sources. The Legal Amazon plays a key role in the generation of renewable electricity in Brazil, hosting four of the country's five main hydroelectric plants (Belo Monte, Tucuruí, Jirau, and Santo Antônio) (SCHUTZE; HOLZ, 2023).

Technological advances and policies aimed at expanding renewable energy have been essential to the global energy transition. In Brazil, hydroelectric plants account for about 80% of domestic electricity generation, making the



Brazilian electricity matrix one of the cleanest in the world. However, the continued expansion of hydropower is increasingly limited by the remoteness and environmental sensitivity of many remaining resources. Dependence on other sources for energy production is also growing, such as natural gas, wind energy (onshore and offshore), and bioenergy (IEA, 2024).

Companies that invest in sustainable practices and renewable energy can obtain significant economic benefits. The Corporate Sustainability Index (ISE) of B3, created in 2005, highlights companies committed to sustainability, including those that develop clean energy projects. Participating in the ISE increases the visibility and attractiveness of these companies to investors, serving as a reference for sustainable investments (B3, 2024).

In this context, this research aims to evaluate renewable energy companies operating in the Amazon and listed on the Brazilian stock exchange (B3), analyzing their financial and operational indicators. Among the main economic indicators to be considered is net revenue, defined as the total revenue of a company minus all sales discounts and returns (INVESTNEWS, 2022). EBITDA (Earnings Before Interest, Taxes, Depreciation, and Amortization) indicates a company's ability to generate profits from its core operations, excluding effects of capital structure, tax regime, and asset depreciation (EMPIRICUS, 2023). In addition, Net Profit represents the final profit available for distribution to shareholders or reinvestment (OMIE, 2023). Another important financial indicator is equity, defined as the difference between a company's assets and liabilities. Finally, Share Capital refers to the amount invested by shareholders or partners in the company, representing ownership participation. Furthermore, this study seeks to identify the challenges and opportunities these companies face when operating in the Amazon, a region with significant energy potential but also marked by logistical, environmental, and financial obstacles. In doing so, the study aims to provide support for future research in the field, offering



an analysis of the performance of these companies and their impact on Brazil's sustainable energy transition, highlighting the role of the Amazon in this global scenario.

METHODOLOGY

The selection of companies operating in the renewable energy sector in the Amazon was carried out through a filtering process on the website of the Brazilian Stock Exchange (B3 – [\[https://www.b3.com.br/pt_br/institucional\]](https://www.b3.com.br/pt_br/institucional)(https://www.b3.com.br/pt_br/institucional)). Initially, a search was conducted by sector of activity, under public utilities, specifically in the electric energy subsector, resulting in the identification of 66 companies. After identifying these companies, an individualized analysis was conducted on their official websites to verify whether they worked with clean energy in generation, transmission, and distribution, and whether they also operated in the Amazon. This process resulted in 15 companies that met the initial criteria.

Next, another individualized analysis was performed with the aim of collecting financial and operational data over a 20-year period (2002 to 2022), in order to develop a financial summary with the main indicators of these companies. The selection of financial and operational indicators was based on those common among the selected companies: net revenue, EBITDA, equity, net profit, and share capital. To ensure the consistency and reliability of the data collected, primary sources were prioritized, such as annual reports, financial statements, quarterly earnings releases, and financial disclosures made available by the companies themselves.

With the collected data analyzed, a comparison of the financial and operational indicators of these companies was conducted over the years to assess their growth and how they responded to specific challenges such as



economic crises, regulatory changes, variations in energy demand, and investments in new technologies.

In parallel with the data analysis, a literature review of scientific articles and studies on renewable energy in the Amazon region was conducted. The review aimed to support the discussions and contextualize the results obtained, providing theoretical and practical support for the study's conclusions. Academic sources and reports from institutions specializing in renewable energy were consulted to deepen the understanding of the region's potential and challenges for clean energy generation.

RESULTS

Fifteen companies in the electricity sector, specifically in generation, distribution, and transmission, operating in the Amazon region and focused on clean energy in the region, were selected from the B3 website, as shown in Chart 1.

The companies Norte Energia, EDP, Ômega, Santo Antônio Energia, Ferreira Gomes, and ENEVA, despite meeting the selection criteria, were excluded from the analysis due to a lack of available data. This left nine companies that met the criteria of being companies in the electricity generation, distribution, and transmission sector operating in the Amazon region, focusing on clean energy in the region, and presenting similar financial indicators, allowing for a more thorough analysis. Financial indicators for the selected companies were collected between 2002 and 2022 to analyze and compare their financial performance over those years. The primary objective was to make a comparison over 20 years. However, it was found that some companies had shorter time spans.



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263

Chart 01 – Selected Companies

NAME	SECTOR			SECTOR	SEGMENT
	GENERATION	TRANSMISSION	DISTRIBUTION		
ALUPAR	AP	AM, RR, PA, MT, MA		PUBLIC UTILITY	ELECTRIC ENERGY
COPEL	MT	MT, MA		PUBLIC UTILITY	ELECTRIC ENERGY
CPFL	TO, MT			PUBLIC UTILITY	ELECTRIC ENERGY
EDP BRASIL	TO, MT	MA, Acre e Rondônia		PUBLIC UTILITY	ELECTRIC ENERGY
ELETROBRAS	PA, RO, MT, AP, AM	TODOS		PUBLIC UTILITY	ELECTRIC ENERGY
ENGIE	RO, MT, TO, MA,			PUBLIC UTILITY	ELECTRIC ENERGY
ENERGISA		PA, MT, AM		PUBLIC UTILITY	ELECTRIC ENERGY
ENEVA	RO, AM			PUBLIC UTILITY	ELECTRIC ENERGY
EQUATORIAL			MA, PA, AP	PUBLIC UTILITY	ELECTRIC ENERGY
FERREIRA GOMES	AP			PUBLIC UTILITY	ELECTRIC ENERGY
NEONERGIA	PA, MT, TO	TO		PUBLIC UTILITY	ELECTRIC ENERGY
Norte Energia	PA			PUBLIC UTILITY	ELECTRIC ENERGY
OMEGA	MA			PUBLIC UTILITY	ELECTRIC ENERGY
SANTO ANTONIO ENERGIA	RO			PUBLIC UTILITY	ELECTRIC ENERGY
TAESA		PA, MA, MT, GO, TO		PUBLIC UTILITY	ELECTRIC ENERGY

Source: Adapted from B3 – Bolsa do Brasil 2024.

Analysis of the selected companies

ALUPAR

Alupar is a privately held, nationally controlled company, founded in 2007, focused on the energy sector, especially in transmission and generation. The company invests both in Brazil and in other Latin American countries. In the transmission segment, Alupar operates 35 systems. In the generation sector, the company has 16 projects, including 4 hydroelectric plants, 4 small hydroelectric

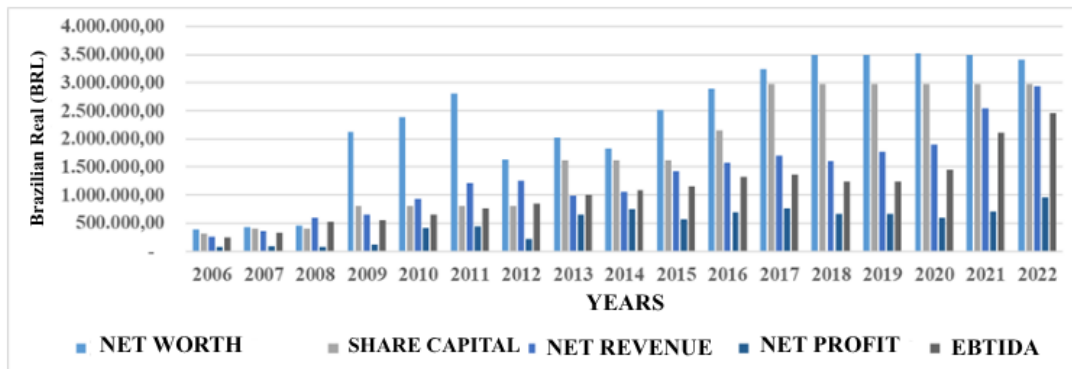


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264

plants, 7 wind farms, and one photovoltaic plant, totaling an installed capacity of 798.5 MW.

Figure 01– Chart of ALUPAR's Financial Performance



Source: Adapted from Alupar, 2024.

Net worth grew from R\$ 393,129 in 2006 to R\$ 3,411,725 million in 2022, peaking at R\$ 3,520,548 in 2020. There was notable growth, especially between 2009 and 2011, followed by a drop in 2012 due to the purchase of ECTE shares. The company's share capital gradually increased, rising from R\$ 314,497,000 in 2006 to R\$ 2,148,533 in 2016 with the aim of reducing debt, financing investments and increasing the liquidity of the Units, remaining at this value until 2022.

Net revenue grew from R\$ 257,420,000 in 2006 to almost 3 million in 2022, demonstrating gradual and consistent growth over the years. Although it experienced some fluctuations, net income followed a growth trend, going from R\$ 78,138.00 in 2006 to R\$ 966,484.00 in 2022. After a drop in 2012 due to depreciation and amortization costs, profit recovered and stabilized. EBITDA jumped from R\$ 241,600 in 2006 to R\$ 2,463,956 in 2022. Although it suffered some fluctuations, especially between 2018 and 2019, EBITDA continued to grow significantly.

COPEL- Companhia Paranaense de Energia.

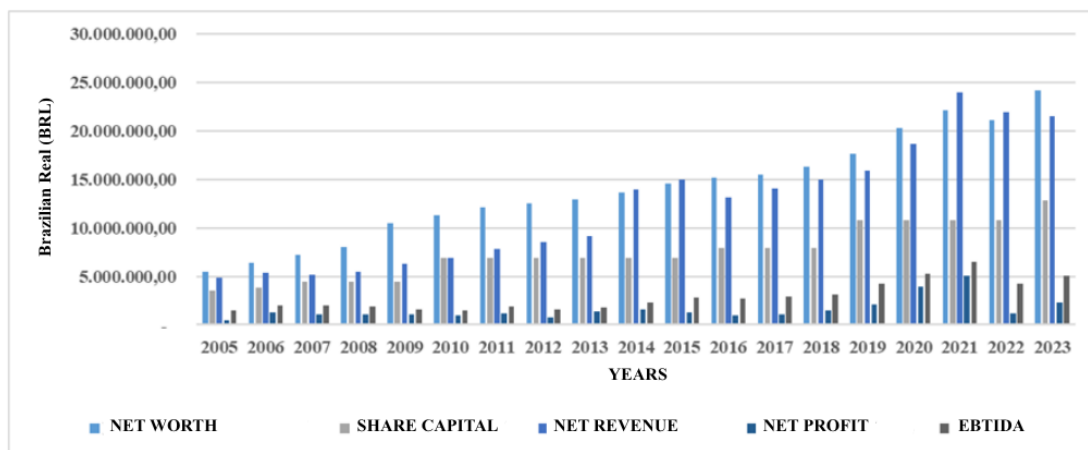


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COPEL is a Brazilian energy company headquartered in the state of Paraná, founded in 1954. The company has a strong presence in the generation, transmission, and distribution of electricity, and stands out for its corporate governance, being included in Level 1 of the BM&FBovespa in 2008.

Copel has a diversified portfolio of 62 self-generating plants, encompassing 18 hydroelectric plants, 1 thermal power plant, and 43 wind farms. The company also participates in another 14 energy generation projects, involving one thermal power plant, 8 hydroelectric plants, 4 wind farms, and one solar power plant. In terms of transmission, Copel maintains more than 6,500 kilometers of lines, between its own assets and partnerships with other companies. Copel plays a significant role in the Amazon region, operating in the electricity segment with hydroelectric plants. In addition, the company plays an important role in energy transmission in Mato Grosso and Maranhão.

Figure 02 – Chart of COPEL'S Financial Performance



Source: Adapted from COPEL, 2024.

Between 2005 and 2023, Copel showed significant growth in its financial indicators, with some fluctuations. The company's net worth grew rapidly until 2021, suffered a drop in 2022 due to increased indebtedness, but recovered in 2023. Share capital also increased gradually over the years.



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Net revenue grew consistently, with notable jumps in 2014, driven by factors such as the recognition of financial assets and liabilities, the sale of energy from the Araucária Thermal Power Plant, and tariff adjustments, and in 2020-2021 due to increases in supply lines and electricity supply, network availability, and sectoral financial results. However, in 2022, revenue fell due to a reduction in electricity revenue and network availability, as well as a drop in sectoral financial results.

Net income, after fluctuations and declines in some years, peaked in 2021 as a result of the renegotiation of hydrological risk, before falling in 2022 due to fiscal factors. EBITDA followed a similar growth pattern, reaching its highest point in 2021.

CPFL Energia - Companhia Paulista de Força e Luz.

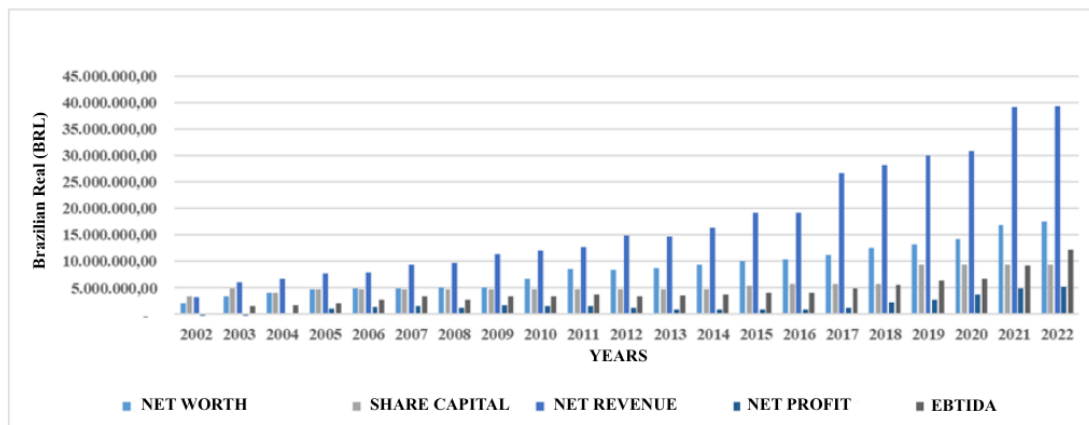
CPFL Energia is a company operating in the Brazilian electricity sector, involved in generation, transmission, distribution, trading, and service provision. Founded in 1912, the company is a leader in renewable energy generation, with over 90% of its critical suppliers evaluated based on sustainability criteria. Focused on research, CPFL Energia owns the Luís Eduardo Magalhães Hydroelectric Power Plant in the state of Tocantins, and two small hydroelectric plants in Mato Grosso.



RELISE

267

Figure 03 – Chart of CPFL's Financial Performance



Source: Adapted from CPFL, 2024

Between 2002 and 2022, CPFL showed consistent growth in its equity, which increased from R\$ 2,144,779 in 2002 to R\$ 17,539,944 in 2022. Share capital remained stable until 2014, ranging between 4 and 5 million, but rose to R\$ 9.3 million in 2019.

In 2003, the company carried out a significant capitalization and made adjustments to its Bylaws to meet the requirements of the Bovespa Novo Mercado, aligning the bylaws of its direct subsidiaries with those of CPFL Energia. In addition, tariffs were adjusted and investments in the distribution sector were maintained, consolidating market position and improving operational results. As a result, net revenue in 2003 more than doubled compared to 2002 and continued to grow significantly, reaching nearly 40 million in 2022, driven mainly by reduced net financial expenses and contractual adjustments.

Net profit, which was negative in 2002, recovered in 2004 due to increased operating profit and reduced financial losses. Despite fluctuations, it continued to grow and reached its highest level in 2022, driven by consolidation in the Generation and Transmission businesses. Furthermore, CPFL Energia made a record investment of R\$ 5.8 billion in 2022 to ensure business sustainability and long-term revenue. EBITDA showed moderate growth until



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2007, with a decline in 2008, but began to rise again from 2017 onward, driven by an increase in Net Operating Revenue.

ELETROBRAS - Centrais Elétricas Brasileiras.

Eletrobrás is one of the largest companies in the Brazilian and Latin American electric power sector, playing a crucial role in the generation, transmission, and distribution of electricity. Its installed capacity represents about 23% of the national total, with 97% coming from clean sources. The company's portfolio includes 35 hydroelectric plants, 9 thermoelectric plants, 20 wind farms, and 1 solar plant, as well as stakes in major projects within the National Interconnected System (SIN). With a wide range of assets and participation in various ventures, Eletrobrás contributes significantly to the country's energy supply.

The company's renewable energy projects in the Amazon are located in the states of Pará, Rondônia, Mato Grosso, Amapá, and Amazonas. Among the main projects are the Tucuruí hydroelectric plant on the Tocantins River, the Samuel plant on the Jamari River, the Coaracy Nunes plant on the Araguari River, the Curuá-Una plant on the Curuá-Una River, and the Balbina plant on the Uatumã River. Eletronorte also holds stakes in other plants, such as Belo Monte on the Xingu River, Dardanelos on the Aripuanã River, and Sinop on the Teles Pires River.

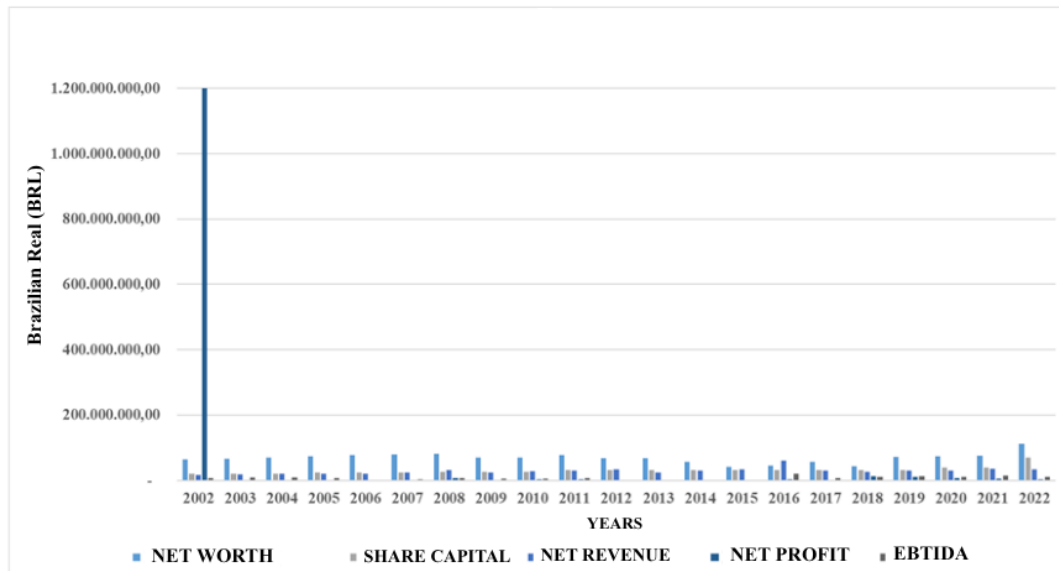
On June 14, 2022, Eletrobras's capitalization was symbolically marked by the traditional bell-ringing ceremony at the São Paulo Stock Exchange (B3), culminating in the transformation of the company into an international-standard corporation.



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269

Figure 04 – Chart of Eletrobrás's Financial Performance



Source: Adapted from Eletrobrás, 2024.

Between 2002 and 2022, Eletrobrás's equity, share capital, net revenue, net profit, and EBITDA showed significant variations. Equity grew until 2008, faced a decline in 2009, but recovered in 2019 and reached a peak in 2022. Share capital increased consistently over the years, with major increments in 2011 and 2022. Net revenue fluctuated, with a decline in 2009 due to the devaluation of the Brazilian real but resumed growth and reached R\$ 60,316,000 in 2016, driven by reductions in operating costs and the increase in net financial results resulting from exchange rate variations and monetary adjustments.

In 2002, Eletrobrás recorded a net profit of R\$ 1.1 billion, driven by the depreciation of the real and dollar-indexed assets, followed by a 70% drop in 2003 due to the appreciation of the real against the dollar. The company partially recovered in 2004, as despite holding a significant portion of its receivables indexed to the U.S. dollar, the profitability of its investment and financing portfolio allowed it to generate profit. From 2012 to 2015, the company suffered losses, worsened by tariff issues, write-offs, the water crisis, and the Lava Jato Operation, culminating in a loss of R\$ 14,442,000 in 2015. After four years of



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270

losses, Eletrobrás returned to profitability in 2016 due to the recognition of remuneration related to credits from the Existing System Basic Network (RBSE). However, fluctuations persisted until 2021, when it recorded a profit of R\$ 5.7 million, still affected by operational provisions. EBITDA also fluctuated, with sharp declines until 2015, followed by recovery and peaking in 2021, before falling again in 2022.

ENGIE

ENGIE, a leading renewable energy company in Brazil, was created in 1994 by Banco Nacional and currently operates in the generation, commercialization and transmission of electricity, gas transportation and energy solutions. With approximately 10 GW of installed capacity in 82 plants, representing 6% of the national capacity, 100% of its installed capacity comes from renewable sources and low greenhouse gas emissions, such as hydroelectric, wind, solar and biomass. The company is listed on the B3 with the ticker EGIE3, is part of the Novo Mercado and has been part of the Corporate Sustainability Index (ISE) since 2005. In 2021, it was included in the Efficient Carbon Index (ICO2).

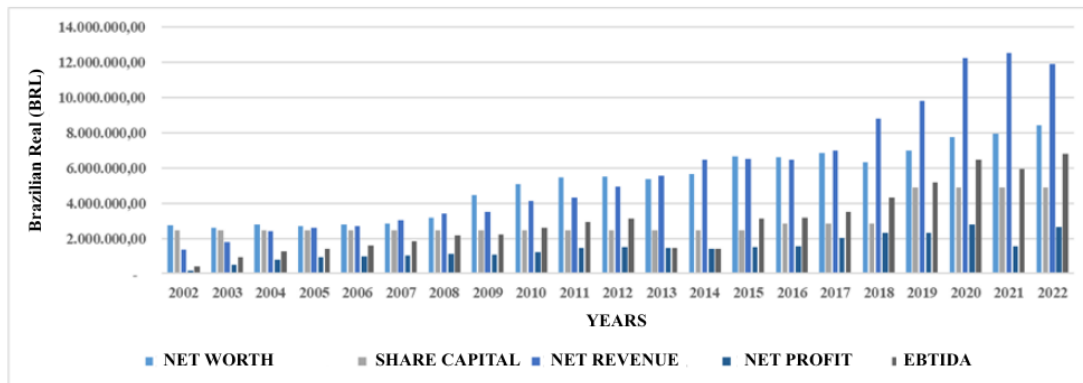
Focused on research, the company has generation in Rondônia, with the Jirau SHP on the Madeira River; in Mato Grosso, with the José Gelázio da Rocha SHP, the Ponte de Pedra hydroelectric plant and the Rondonópolis plant; in Tocantins, with the Cana Brava and São Salvador hydroelectric plants; and in Maranhão, with the Estreito hydroelectric plant.



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271

Figure 05 – Chart of ENGIE's Financial Performance



Source: Adapted from ENGIE, 2024.

Between 2002 and 2022, the company experienced consistent growth in several financial indicators. Net worth remained stable at around R\$ 2 million until 2007, but began to rise more noticeably in 2008, reaching R\$ 8.4 million in 2022. Share capital, initially constant at R\$ 2,445,800 million, saw gradual increases, reaching R\$ 4,903 million in 2019 and remaining at that level until 2022.

Net revenue grew from R\$ 1,363,400 in 2002 to almost R\$ 12 million in 2022. Profits and EBITDA also experienced significant growth, with profit increasing from R\$ 183,000 in 2002 to R\$ 2.6 million in 2022, despite some temporary dips. EBITDA rose from R\$419,000 to over R\$6 million in the same period, with temporary declines in 2013 and 2014, but an immediate recovery.

ENERGISA

Energisa, founded in 1905, is a Brazilian company in the electricity sector, focusing on energy distribution, generation, and transmission. Energisa Transmissora operates a wide transmission network in the states of Pará, Mato Grosso, and Amazonas. The company owns two photovoltaic plants and is implementing a project in partnership with the federal government to provide energy to isolated communities in the Amazon through photovoltaic modules and

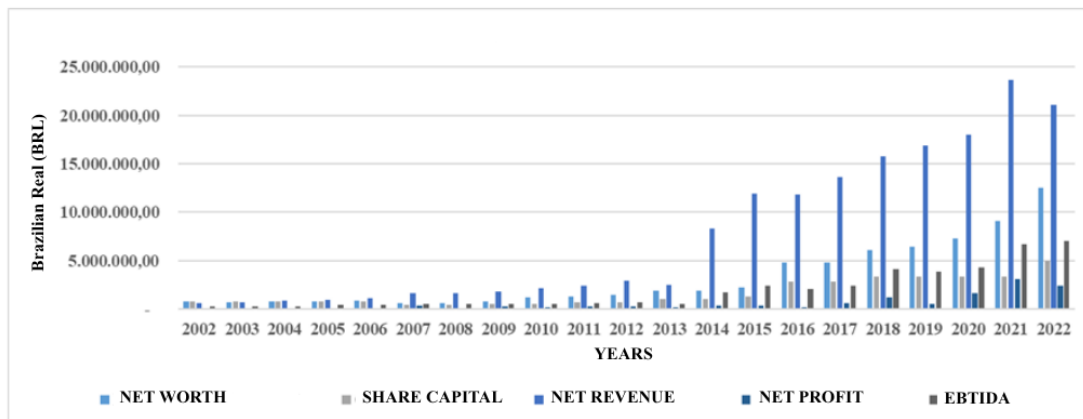


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272

batteries (LEITE, 2021). In addition, it develops the Ilumina Pantanal program, bringing renewable and safe energy to the inhabitants of the biome.

Figure 06 – Chart of ENERGISA's Financial Performance



Source: Adapted from ENERGISA, 2024.

The company's equity began at around R\$ 700 thousand, experienced a decline in 2008, but later recovered, surpassing R\$ 1 million starting in 2010 and reaching R\$ 12.48 million in 2022. Share capital remained stable until 2006, dropped sharply in 2007 due to the incorporation of Multipar, and then grew again, reaching nearly 5 million in 2022.

Net revenue showed significant growth, rising from R\$ 609.8 thousand in 2002 to R\$ 21.095 million in 2022, with a notable jump between 2013 and 2014 driven by energy distribution operations, reaching R\$ 23.692 million in 2021. In 2022, however, revenue fell to R\$ 21.095 million as a result of lower taxation and the absence of tariff flags in the Distribution segment.

In 2002, Energisa recorded a loss of R\$ 23,349, impacted by tariff adjustments and energy transactions. The company reversed the loss in 2003, with profits continuing to grow until 2007. However, in 2008, profit fell to R\$ 105,000 due to non-recurring effects and accounting changes. Between 2009 and 2019, the company's net profit varied significantly. The peak was reached in 2021, driven by net financial revenue, but there was a decline in 2022 due to a



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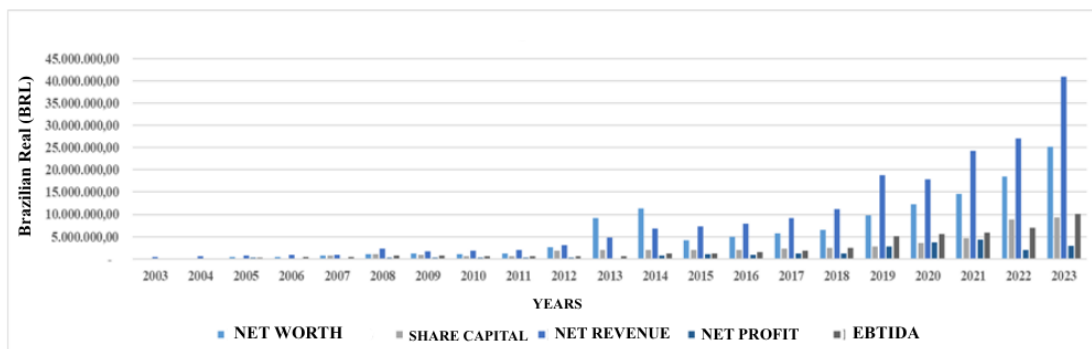
273

drop in net operating revenue, reduction in tariff flags, and a negative financial result. EBITDA followed a similar pattern, growing consistently after 2009 and reaching R\$ 6,996,200 in 2022.

Equatorial Energia

Equatorial Energia S.A. is a Brazilian holding company in the public utility sector, founded in 1999. The company has been advancing in the consolidation of the energy distribution sector in Brazil. The company owns twelve wind farms in operation, in addition to solar parks under construction, such as those in Ribeiro Gonçalves and Barreiras 1. The company also develops projects such as the More Light for the Amazon Program (MLA), which facilitates access to electricity in remote regions of the Legal Amazon, and the E+ Recycling program, which encourages the selective collection of waste.

Figure 07 – Chart of Equatorial's Financial Performance



Source: Adapted from Equatorial, 2024.

Net worth grew robustly until 2009 but fell in 2010 due to the transfer of assets to the Redentor company, subsequently recovering. Share capital also increased, reaching R\$ 9,308,724 in 2023, with some fluctuations over the years. Net revenue grew from R\$ 422,586 million in 2003 to R\$ 6,773,453 million in 2010, driven by the increase in the volume of energy sold by CEMAR and the start of Geramar's commercial operations. In 2017, the tariff readjustment



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(CELPA) and review (CEMAR) processes caused a jump to R\$ 9,071,420 million and continued to grow until 2023.

Net profit, after a negative start in 2003, varied over the years, mainly due to the consolidation of CELPA, tariff review at CEMAR and increased energy costs. Having experienced a remarkable recovery in 2023, reaching R\$ 2,876,284 million. EBITDA also showed significant growth, especially from 2018 onwards, reaching R\$ 10 million in 2023, due to improved margins and the consolidation of new assets.

Neenergia

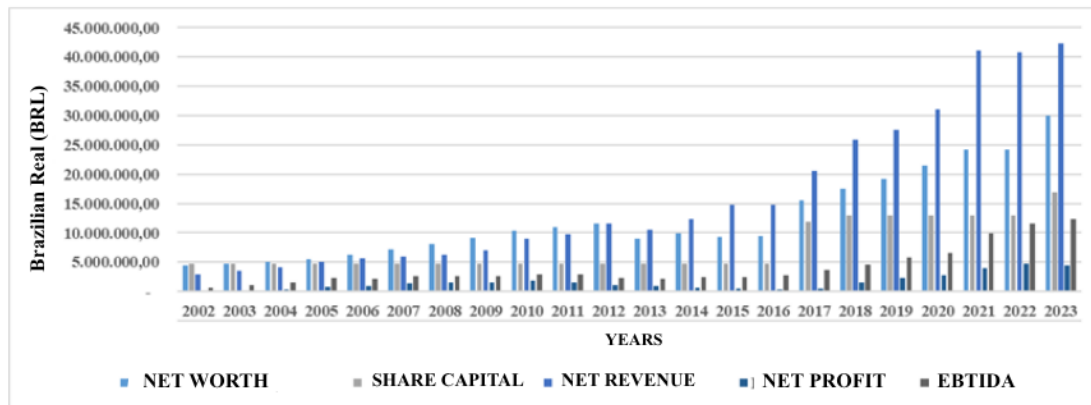
Neoenergia, founded in 1997, is a publicly traded company with shares (NEOE3) traded on the São Paulo Stock Exchange. A subsidiary of the Spanish group Iberdrola, it is an integrated energy company operating in the segments of networks (distribution and transmission), renewables (wind, hydroelectric and solar generation) and liberalized (thermal generation and energy trading). For the fourth consecutive year, it is part of the B3 S.A. Corporate Sustainability Index (ISE). Neoenergia operates several hydroelectric plants, including the Belo Monte HPP, located on the Xingu River in Pará, one of the largest hydroelectric plants in Brazil; the Teles Pires HPP, located between the states of Mato Grosso and Pará, on the Teles Pires River; and the Dardanelos HPP, located on the Aripuanã River in the state of Mato Grosso, among others, in addition to having transmission operations in Tocantins.



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275

Figure 08 – Chart of NEONERGIA's Financial Performance



Source: Adapted from NEONERGIA, 2024.

Between 2002 and 2023, the company experienced significant growth across several financial indicators. Equity increased from R\$ 4.4 million to R\$ 30.1 million, with faster growth beginning in 2017. Share capital remained stable until 2016 but rose substantially after 2017, reaching R\$ 16.9 million in 2022. Net revenue also grew consistently, from R\$ 2.9 million to R\$ 42.4 million, despite a decline in 2013.

Due to the drop in net operating revenue and the slow recovery of consumption following the end of the energy rationing period, the company recorded a loss of R\$ 92,999 in 2002. However, the situation reversed in the following years, with profits increasing until 2010 and a decline occurring between 2011 and 2017. Recovery began in 2018, driven by the incorporation of Elektro Holding, tariff reviews, and the annual adjustments of Celpe and Elektro. In 2022, the company achieved its highest net profit, R\$ 4,718,000, due to several factors, including the incorporation of Bahia PCH III by Neoenergia Brasília, followed by a decline in 2023. EBITDA experienced significant growth, rising from R\$ 644 thousand to R\$ 12.4 million, with the largest increase occurring after 2017, reflecting business expansion and tariff revisions.

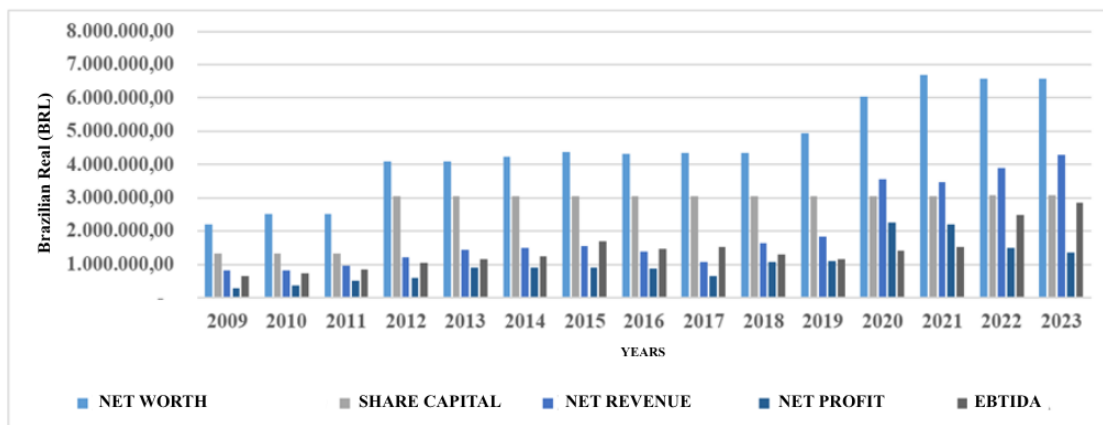


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TAESA - Transmissora Aliança de Energia Elétrica S.A.

TAESA is one of the largest electric power transmission companies in Brazil, founded in 2009, with operations in all regions of the country. Listed on the São Paulo Stock Exchange (B3) since 2006, and controlled by CEMIG and ISA Brasil, TAESA is recognized for its corporate governance, sustainability, and organizational climate. It is included in the B3's ICO2 and IGPTW indices and is part of the Novo Mercado, a segment that brings together companies with the highest standards of corporate governance. Focused on this research, it operates in the transmission sector in the states of Pará (PA), Maranhão (MA), Mato Grosso (MT), Goiás (GO), and Tocantins (TO).

Figure 09 – Chart of TAESA's Financial Performance



Source: Adapted from TAESA, 2024.

Net worth increased from R\$2.2 million in 2009 to R\$6.5 million in 2023. Share capital remained stable until 2011, doubled in 2012, and remained almost constant until 2023. Net revenue and net profit grew steadily until 2015, suffered declines due to inflation, and recovered from 2018 onwards, driven by the adoption of CPC 47, acquisitions, and increased monetary correction. EBITDA, after periods of instability, also recovered, reaching R\$2.8 million in 2023.

Analysis of the feasibility of renewable energy in the Amazon



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In general, CPFL and Equatorial stood out as the companies with the best overall performance, considering the consistent growth of their financial indicators over the years. Eletrobrás had the highest equity among the listed companies, in addition to recording the largest increase in share capital. Despite significant fluctuations over the years, the company stands out for the impact of its variations on the market and its capacity for recovery.

Neoenergia showed continuous growth despite declines in some periods, with significant increases in its net revenue and share capital. Meanwhile, Energisa, ENGIE, TAESA, and COPEL remained more stable, with moderate growth. Alupar showed more modest and steady growth.

According to Araújo et al. (2021), the Amazon has vast potential for renewable energy generation, especially through hydropower, solar energy, and biomass. The combination of hydroelectric and solar energy can meet the energy demand of isolated communities. Among these energy sources, solar stands out due to its feasibility in the region. Solar energy is one of the most promising alternatives for the Amazon, as the region has high levels of solar radiation throughout the year, which favors the installation of photovoltaic panels. According to Viana (2024), the Amazon receives an average of 5.5 kWh/m² of daily solar radiation.

In Brazil, electricity generation from wind is still limited, and to use wind resources as an energy source, it is necessary to assess the local wind potential, which requires high-quality data. In Brazil, as in many places, adequate data for this assessment are lacking (Pinto; Martins; Pereira, 2017). The logistical and environmental challenges of installing wind turbines must also be considered, and they need to be carefully managed to avoid negative impacts on biodiversity (Lima, 2023).

The Amazon is essential for renewable electricity generation in Brazil, housing four of the country's five main hydroelectric plants and contributing to



RELISE

278

82% of the nation's energy coming from renewable sources (Schutze; Holz, 2023). Small Hydropower Plants (PCHs) represent an interesting alternative in the Amazon, given the region's extensive hydrographic system. PCHs have a lower environmental impact compared to large dams and can provide sustainable energy to local communities (Alencar, 2020).

The growing global concern for the environment and sustainable development is encouraging technological research to reduce energy generation costs and incorporate learning effects (Freitas; Dathein, 2013). Due to the increasing importance of sustainable development, investors are increasingly seeking socially responsible and sustainable companies. These investments, known as socially responsible investments (SRI), assume that sustainable companies generate long-term shareholder value and represent a sustainable competitive advantage (Barney; Herterly, 2010). This trend reflects a growing need for companies to adapt to new market realities.

According to Hart and Milstein (2004), corporate management has begun to consider the need to adapt to new market demands and requirements, aiming to consolidate strategic differentiators. Zylbersztajn and Lins (2010) emphasize that, under current market pressures, companies that fail to incorporate the concept of sustainability will struggle to survive in the coming decades, and Heloani (2005) reports that, in some cases, sustainability is already a matter of survival. If companies do not adapt to new trends, they risk disappearing for not meeting market expectations.

The economic viability of clean energy in the Amazon depends on several factors, including implementation costs, maintenance, and the necessary infrastructure. Although the initial costs of installing solar and wind systems are high, these investments pay off over time through reduced operating costs and energy independence. In addition, using local resources reduces dependence on imported fossil fuels, generating significant savings (ANEEL, 2023).



RELISE

279

The Economic Commission for Latin America and the Caribbean (CEPAL, 2023) highlights the importance of incentive mechanisms for innovation in clean technologies in Brazil. These incentives may include subsidies, tax exemptions, and favorable financing, which help reduce the investment payback period and attract investors to the region. Case studies show that, with proper support, clean energy projects are viable and can be an effective pathway to decarbonization and sustainable development in the Amazon.

According to Sato (2022), the creation of sustainable energy stimulates economic and social growth. Santana (2023) highlights that the increase in the share of renewable sources in the Brazilian energy mix is attracting more and more investments. Government incentives and subsidies are essential to economically enable clean energy projects in the Amazon. The “Energias da Amazônia” program, established by the Federal Government in 2023, is an example of public policy aimed at reducing diesel use by replacing it with renewable sources (Brasil, 2023). Other programs include the Incentive Program for Alternative Energy Sources (Proinfa) and the “Luz Para Todos” program (Brasil, 2024). In addition, B3 has implemented the Corporate Sustainability Index (ISE), which evaluates company performance in terms of environmental, social, and governance (ESG) practices. Companies in the clean energy sector that excel in these practices have the opportunity to attract investors interested in supporting sustainable initiatives and improving their corporate image.

CONCLUSIONS

The Amazon, with its vast potential for generating renewable energy—especially hydroelectric and solar—stands out as a region of great importance for Brazil’s sustainable energy future. The scarcity of data and in-depth research on other renewable energy sources, such as wind and biomass, represents a



RELISE

280

significant challenge, since having multiple alternatives is essential for expanding the diversity of the region's energy matrix and minimizing environmental impacts.

The companies analyzed demonstrate a strong commitment to the development of clean energy projects, contributing to the diversification of the energy matrix and the reduction of greenhouse gas emissions. According to the data analyzed, these companies experienced consistent growth over the span of 20 years, despite some periods of economic fluctuation. The growing global concern for the environment and sustainable development is driving technological research and investments in sustainable companies, reflecting a need for businesses to adapt to the new demands of the market.

The economic viability of clean energy in the Amazon presents challenges, mainly due to high initial costs, but these are offset by reduced operational costs and long-term energy independence. The lack of infrastructure in remote areas of the Amazon also heightens logistical challenges, but technological advances and energy efficiency can help mitigate these obstacles. Government incentives are essential to make clean energy projects feasible.

The proposal to invest in renewable energy in the Amazon brings significant benefits by promoting sustainable development, generating jobs, and improving the quality of life for the local population. In addition, it ensures energy independence and aligns with global goals, especially the UN's Goal 7. This study may serve as a foundation for future research and public policies aimed at expanding the adoption of renewable energies in the Amazon—a region with immense potential that remains underutilized—while also contributing to the broader debate on sustainable development.



RELISE

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