

THE INVESTOR'S HANDBOOK FOR RENEWABLE ENERGY IN BRAZIL

AN INSIDER'S GUIDE



REA CONSULT

Preface

Favorable geographic conditions, growing electricity demand, progressive regulatory reform, and maturing supply chains, have made Brazil one of the most exciting countries in the world for renewable energy investment.

According to Bloomberg's **2019 Climatescope report**, Brazil ranks third most attractive in the world for clean energy investments. Brazil also ranks third globally in terms of installed capacity from renewable energy sources, after only China and the United States, according to **IRENA** analysis. Despite this, Brazil only ranks 7th in the world for installed wind power capacity and 22nd for solar.

The real renewable power in Brazil comes from hydroelectric, where it is only second to China. Large hydropower plants account for around 80% of domestic electricity generation, providing flexible and low-emission base power supply. However, further expansion is constrained by the remoteness and environmental sensitivity of remaining hydropower resources.

As a result, reforms in the Brazilian energy market over the last decade have focused on diversifying the country's energy mix. While natural gas plays a role in this new power landscape, the key focus has been to promote the development of wind and solar power generation by creating the technical, socio-economic, and political conditions required to encourage investment.

Transmission capacity and technology have improved to account for intermittent supply, new financing mechanisms have been put in place to suit a wide range of projects, and more supportive regulation has been established. From 2017 to 2020 (ytd) the average annual installed capacity growth of centralized solar power was approximately 35%. In the same period, distributed solar power grew by more than 120% on average, benefiting from the world's most progressive net metering regulation. The more mature wind sector saw an average increase in

the generation capacity of 8% per year, while total wind capacity is expected to double between 2017 and 2024.

There is a famous saying here, we say that "Brazil is not for beginners". Despite reform, Brazil is still an emerging market with many of the inefficiencies and cultural hurdles

you would expect of a populous Latin American country. However, those who can navigate Brazil's dense legal and regulatory jungle will discover a renewable energy market that is brimming with potential. Since I began working in the renewable energy sector, I have seen markets peak and stall. The conditions are right, now is the time for Brazil.

The Investor's Handbook for Renewable Energy in Brazil has been developed by REA Consult to support that journey. It serves as an insider's guide for those developing projects renewable energy in Brazil and anyone curious about the inner-workings of this lucrative market. A new chapter will be released every week, all free to read and share. See all the chapters published so far and **follow the evolving story here**



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REA Consult is a management and consulting firm committed to building bridges for international sustainable investments. Born in Brazil with offices in Europe, Asia, and South America, REA Consult has a global track record of supporting successful projects.

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THE BRAZILIAN ELECTRICITY MARKET

A DUAL MARKET CONTRACT MODEL SERVING AN AREA THE SIZE OF EUROPE THAT IS SEEING RAPID GROWTH WHILE UNDERGOING MAJOR REFORM

-
- △ The Dual Market Model
 - △ Unregulated Contracts

- △ Regulated Contracts
- △ Price for the Differences

The Brazilian Electricity Market



Overview

Brazil's interconnected transmission grid covers an area as large as continental Europe. The grid is operated centrally by the Operador Nacional do Sistema Elétrico (ONS), which is responsible for physical dispatch across the entire system. Where financial revenues for power plant owners are primarily determined by their PPAs and the underlying physical guarantees, the ONS operates as if all plants belong to the same owner.

The Brazilian electricity market is based on wholesale competition. The gradual implementation of retail competition proposed as part of the first sectoral reform in 1995 was abandoned. Today, only large consumers with power demand in excess of 3 MW are able to choose their supplier.

The current proposal for power sector reform aims at retail competition for all consumers, and since 2004, electricity has been commercialized in two different contractual environments: regulated and unregulated markets.

The Dual Market Contract Model

Brazil adopts a dual model when it comes to the energy market:

- △ **Unregulated Market** — Ambiente de Contratação Livre (ACL): where buyers and sellers are unregulated to negotiate.
- △ **Regulated Market** — Ambiente de Contratação Regulada (ACR): where public bids set conditions for distribution companies to meet their demand.

Each has its own contract processes, which we explore in more detail below.

Unregulated Market Contracts

In the unregulated market (ACL), only "unregulated consumers", those with a minimum demand of 3MW can purchase their electricity directly from generators and traders in Brazil.

However, in order to promote renewable energy, "special consumers" those with a minimum demand of 500 kW are also allowed to participate in the ACL, as long as they purchase their electricity exclusively from renewable sources.

Energy prices and contract terms and conditions are negotiated bilaterally in the ACL.

Currently, the ACL accounted for 31% of national electricity consumption and 86% of industrial and commercial electricity consumption.

As much as 24% of the wind and 22% of the solar power generation in the country is sold in the ACL.

By the end of 2017, there were 5,158 consumers in the ACL. By 2020, this number grew to 7.812, of which 978 were unregulated consumers and 6,834 special consumers. However, the

number of special consumers has increased significantly, demonstrating significant interest for renewable energy generation.

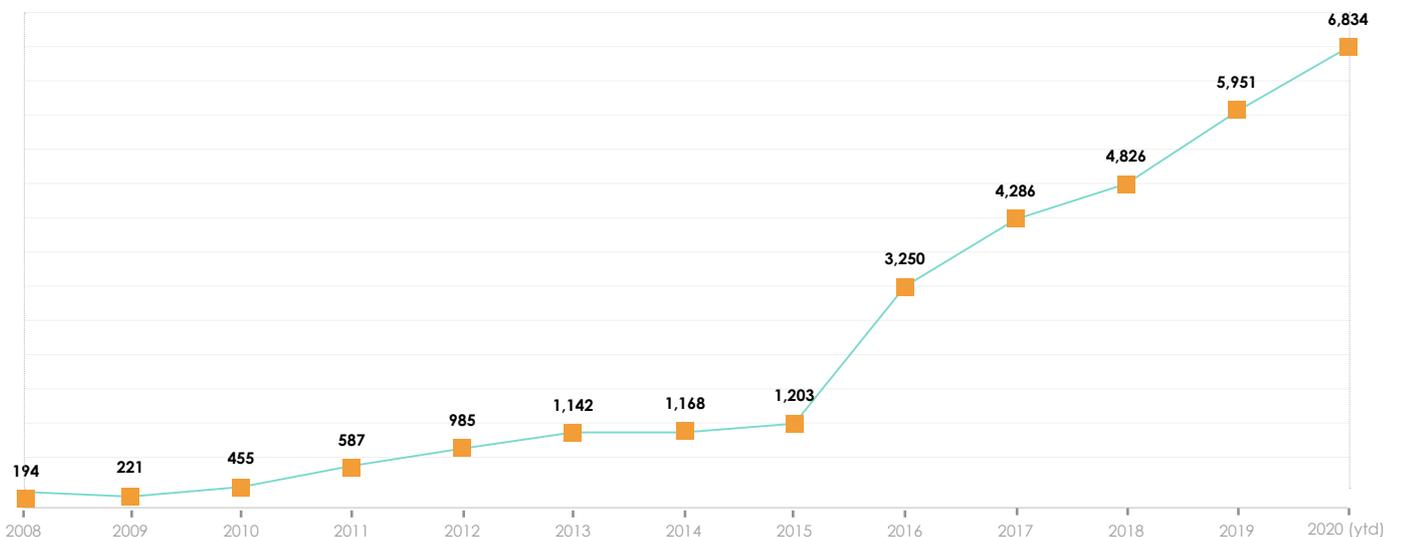
ACL contracts are applicable to any of the following regulated agents:

- △ Concessionaires
- △ Permittees
- △ Authorized contractors
- △ Generation registry owners
- △ Energy traders
- △ Energy importers and exporters
- △ Unregulated consumers
- △ Special consumers

Energy contract terms, including price and delivery, are formalized through what is known as "Contratos de Compra de Energia no Ambiente de Contratação Livre" or CCEAL. Renewables (sometimes referred to as "promoted" or alternative energy) use a contract classification of their own:

- △ Qualified Cogeneration Energy Contract
- △ Special Consumer Energy Contract
- △ Special Consumer Conventional Energy Contract

Number of special consumers in de ACL (2008-2020)



* ABRACEEL 2018



For any of them, the energy seller must adhere to a few peculiarities, set through laws or otherwise in normative rulings, granting the buyer a distribution tariff discount (anywhere between 50% to 100%) while awarding additional benefits to the seller, depending on how the project is qualified.

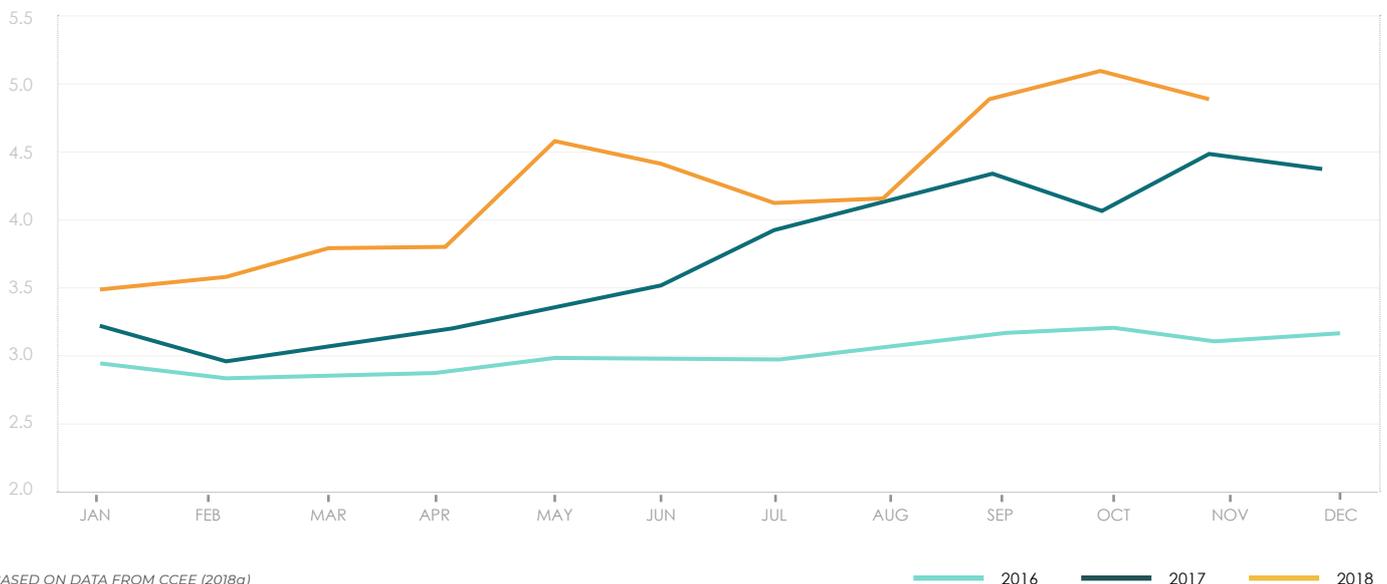
Unregulated market contracts have the advantage of being very flexible, allowing for a variety of formats. The most common clauses include:

- △ Price (and percentage, in case it is a "promoted" source)
- △ Seasonality

- △ Correction index
- △ Guarantee
- △ Trading chamber costs
- △ Management clause
- △ SIN sub-markets (the national grid system is divided into sub-market)

Brazil's power trade chamber the Câmara de Comercialização de Energia Elétrica (CCEE) evaluates the liquidity of the ACL using a turnover index —based on the relationship between the total volume of electricity traded by ACL agents and the total volume of purchase contracts concluded by all ACL consumers. Recent years show a steady upward trend.

Turnover index for the ACL



* BASED ON DATA FROM CCEE (2018a)

Regulated Market Contracts

Unlike the unregulated market, contracts in the regulated market are auctioned contracts, which means that they follow specific norms in terms of price and sub-markets, as well as the supply period. Auctions are held at CCEE, on ANEEL's behalf.

Having their own contract identification registries, both are netted and cleared through the country's only trading chamber.

Regulated market auction contracts

Decree 5,163/04 determines the many contract standards (CCEAR) adopted in Brazil:

- △ **By Quantity (CCEARQ)** – mostly hydro generators and distribution companies connected to the SIN network. In this contract, the seller faces hydrological risk (whether it will be dispatched by ONS, the regulating agent). Therefore, this component needs to be properly priced in the plant's expected revenue.
- △ **By Availability (CCEARD)** – thermal and alternative energy generators, when contracting with distribution companies. Unlike CCEARQ, risks are shared among counterparties, as defined in each auction bid.
- △ **Adjustment** – applicable to adjustment bid auctions, where distribution companies match existing contracts to forecast deviations, allowing for an additional 5% limit of the previous year's contracted quantity, for a 2-year supply timeframe.
- △ **Reserve energy** – promotes equilibrium between the system's physical coverage and the individual physical coverages of each participating plant. Specific auctions are held, occasions on which biomass, wind, solar and small hydro plants sign contracts (known as CER) with any of the trading chamber's CONUER selling agents (distribution companies, unregulated and special consumers, as well as self-producers).

Auctions have their own official wording, which indicates the prevalent kind of contract:

- △ Sell auction
- △ Alternative sources auction
- △ Surplus auction
- △ Structural auction
- △ Reserve energy auction
- △ New energy auction
- △ Existing energy auction
- △ Purchase auction
- △ Adjustment auction

Each auction public bid has its own enrollment requirements:

- △ Plant structure
- △ Energy quantity
- △ Authorization
- △ Technical characteristics
- △ Among others

This auctioned energy environment is also responsible for other, non-auctioned, contracts:

- △ **Proinfra** – applicable to the program's participating agents (biomass, small hydro and wind projects represented by Eletrobras), called Proinfra Trading Agents (ACEPs) at CCEE, and authorized buyers (distribution companies, unregulated and special consumers, and self-producers)
- △ **Itaipu** – specific for Eletrobras (identified as ACEI in the trading chamber CCEE) and the quota system distribution companies
- △ **Physical coverage quota** – applicable to hydro plants that have undergone concession renewals and their distribution counterparties
- △ **Nuclear energy quota** – used by the country's nuclear power plants (Angra 1 and 2, belonging to Eletrobras) and distribution counterparties
- △ **Regulated Bilateral (CBR)** – applied only on very specific situations, has its own set of rules and agents.

The following table is a quick reference tool of the above-mentioned contracts:

Contract Type	Seller	Buyer
CCEARQ	Generators	Distribution companies
CCEARD	Generators (thermal and alternative)	Distribution companies
Adjustment	Generators	Distribution companies
Reserve energy	Generators (biomass, wind, solar and small hydro)	Distribution companies, unregulated and special consumers, self-producers
Proinfa	Eletrobras (biomass, wind and small hydro)	Distribution companies, unregulated and special consumers, self-producers
Itaipu	Eletrobras	Distribution quota system companies
Physical coverage	Renewed concession hydro plants	Distribution companies
Nuclear energy	Eletrobras/Eletronuclear	Distribution companies
CBR	Generators and distribution companies	Distribution companies and electric-intensive consumers

Main characteristics of the unregulated market (ACL) and regulated market (ACR):

Characteristics	Unregulated (ACL)	Regulated (ACR)
Participants	Generators, traders, unregulated and special consumers	Generators, distribution companies and traders (for existing energy only)
Contracts	Flexible contractual terms set by buyers and sellers	CCEAR auction contract standard
Contract type	Agreed between buyer and seller	Established by ANEEL (regulating agency)
Price	Agreed between buyer and seller	Set by auction

Price for the Differences

In the Brazilian electricity market, the price that better represents a spot price is the Settlement Price for the Differences (PLD), that is the price at which the differences between the actual amount of energy produced or consumed and contracts are settled at the Electric Energy Trading Chamber – CCEE.

As CCEE is the country's trading chamber for physical contracts, all energy participating agents are exposed to its PLD. Set weekly for each load threshold, on an "ex-ante" (forecasted) basis, it is calculated according to the marginal generation cost, providing a periodical price band (minimum and maximum) for each sub-market.

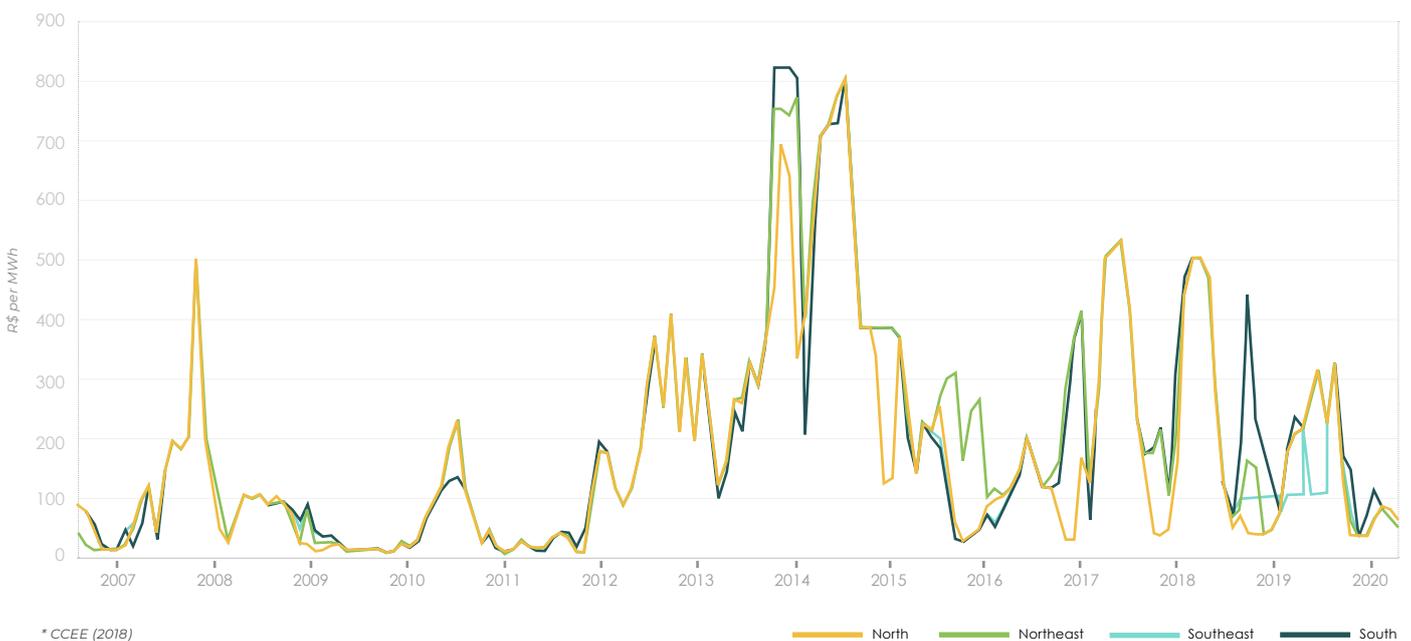


The mathematical models supporting PLD prices seek the optimum result between hydro energy benefits and adequate reservoir levels. As hydro accounts for 2/3 of all generating capacity in the country, this explains why the reference price is overwhelmingly impacted by hydro plants operations.

The graph below shows the development of PLD from 2008 to 2020 for each of the four subsystems. The spikes and elevated prices since 2013 are a result of unfavourable and prolonged hydrologic conditions. This underlines both the importance of hydroelectric power for Brazil and the rapidly changing environment, reinforcing the need for greater diversification in the energy mix.

However, PLD dynamics are due to change significantly in January 2021, when hourly PLD becomes effective. Sector agents in Brazil have been working on the new methodology since 2018, in order to support its proper implementation. REA Consult will make a monitoring tool for the upcoming hourly PLD available on its homepage. Visit www.rea-consult.com to access this content.

Monthly average PLD values in R\$ per MWh (2008–2020)



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Please note that the energy field is dynamic, and the material and data presented herein could change.

Sources

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ABEEólica	Brazil Government	CTGAS-ER	Instituto Acende
ABSOLAR	Canal Energia	EPE	MME
ANEEL	CBFT	EXAME	ONS
BDNES	CCEE	IBD Group	Valor Sectorial Energia

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