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WHITE PAPER

Building a Smart Brazilian Electricity Market

Salvador (BA), November 2012

INTRODUCTION

This White Paper has been developed by the Chamber of Electric Energy Commercialization - CCEE in collaboration with its partners EPEX SPOT SE and ECC AG, in response to increasing needs from the Brazilian community for a competitive, sustainable and secure electricity market. It focuses on its vision of "Building a Smart Brazilian Electricity Market" and stresses important aspects that should be thoroughly incorporated to improve the Brazilian market design within the next five years, in order to facilitate the transition towards a more mature and efficient market.

The pillars of Brazilian market design are: (i) to assure the security of supply; (ii) to promote price and tariff modicity and (iii) to universalize the access to electricity services. Within the framework of the Regulated Contracting Environment (RCE), regulated activities run by CCEE under National Electricity Regulatory Agency - ANEEL supervision have been the path founded to accomplish with the first two objectives. Long term (15-30 years) Power Purchase Agreements resulting from a descending price auction guarantee the investment necessary to support load growth at minimum cost. The success of this approach relies on an organized market providing a transparent price formation and financially backed by receivables.

On the other hand, the Free Contracting Environment (FCE) is dominated by over-the-counter (OTC) transactions and suffers from typical unorganized market problems, such as asymmetric information and low liquidity. Without reliable long-term price signals and financial security, which are necessary conditions to support investment, the current FCE design does not contribute to the security of supply on a sustainable basis, regardless it is playing an important role in terms of short-term cost reduction.

There is a remarkable need of development for the Brazilian Electricity Market in order to get a business friendly environment to long-term investments in generation, aiming the full security of supply including the FCE. Lessons learned from regulated auctions make us conclude that an organized market, with a transparent price formation and financially secured can induce the desired behavior. With respect to the price and tariff modicity objective, the government had the opportunity to reduce electricity cost to end-user by dealing with the expiration of several concessions in the electricity supply chain (20% of generation capacity and 67% of transmission lines). The measures adopted, backed by an international consulting report[1] , establish the conditions to renew the current concessions. Concessionaires willing to renew their concessions must submit themselves to a new tariff regime which takes into account only operational and maintenance cost, given that investment are already recovered.

The benefit resulting from transmission rates reduction will be spread to all market participants while the benefit in generation segment will be directed addressed to the RCE. Considering also the reduction of some energy charges, the forecast reduction in end-user tariffs of RCE will range from 16.2% (householders) to 28% (industry).

[1]*Ashley C. Brown: Concessions, Markets and Public Policy in the Brazilian Power Sector*

The benefit for the free market, regarding the generation segment, will have indirect effect since the RCE rates are benchmarks for long-term pricing in the FCE. However, this price discovery procedure can be significantly enhanced by organizing the market environment with standardized products, straightforward processes and financial security.

Marketplaces, as illustrated in Figure 1, are the key cornerstone of the wholesale electricity market by providing flexible instruments for efficient, transparent and secure transactions of standardized products. A trading environment with standardized products will lower the transaction costs and increase the liquidity, leading to robust price formation. Financial security is achieved by means of a centralized settlement carried out by clearing houses which are entities specialized on financial operations and financial security systems.

The purpose of this paper is to underscore the role of marketplaces in driving forward the Brazilian Electricity Market by market-based solutions. Besides representing the best practices adopted in major worldwide electricity markets, these initiatives are also aligned to the commitments of the G-20 Leaders signed in Pittsburgh, in September 2009, concerning standardization, central clearing, electronic trading and reporting of OTC derivative transactions.

Finally, it is worth to pointing out that the initiatives described in this White Paper will develop competition of the Brazilian wholesale market and economy as well as enhance price transparency.

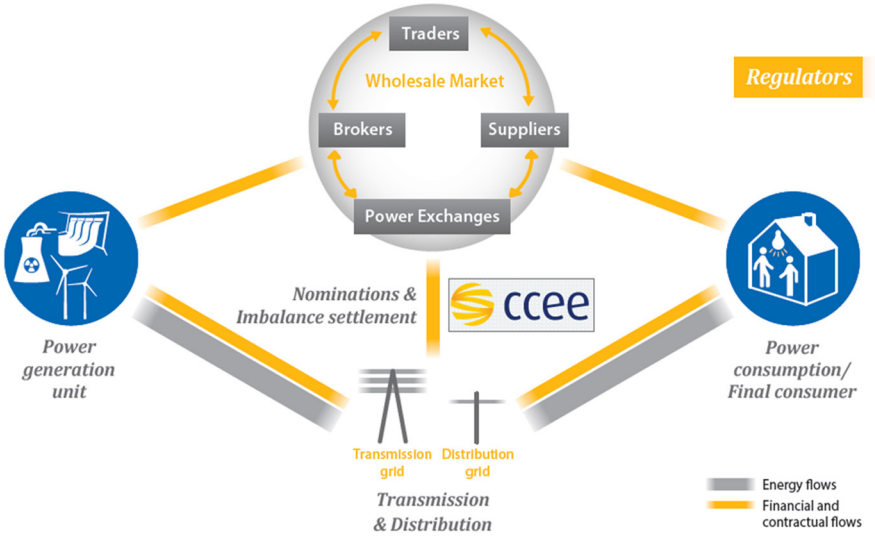

Figure 1 – Organized Market Framework

1. FROM TRANSPARENT PRICE FORMATION AND FINANCIAL SECURITY…

In the last decades, the electricity industry has been restructured in order to improve its general efficiency, including adequate level of investments and optimal utilization of existing resources. Assuring the fulfillment of the restructuring objectives is crucial since the competitiveness of a Brazilian industry is strongly linked to the competitiveness of its electricity industry.

The Brazilian market design distinguishes two major markets to tackle with efficiency incentives: the contract market and the imbalance (or difference) market. The former, particularly the long-term contract market, aims at supporting investment whereas the latter is closely related to optimal physical operation and its price, the Differences Settlement Price – PLD (short-term price), results from computational model used to minimum cost dispatch. In this white paper, we are mostly interested in the contract market of FCE.

We believe that the maturity level of a market, and hence its level of efficiency, can be defined in terms of three essential attributes:

- **Neutrality:** The rules which govern the market (specially trading and clearing) are publicly known, available to all market participants and applied on the same way whatever the market participants. In practice, each market participant's outcome will be consequence of its own efforts and the market conditions.

- **Symmetry of information:** All participants have access to the same market information. In practice, each market participant will always make the best possible decision at a given time, given the available public information.

- **Liquidity:** The capacity of a market to enable its participants to perform their orders quickly (immediacy), without significant impact on the price (resilience). In practice, each market participant can close out an open position whenever it is no longer attractive, supporting risk management procedures.

Market maturity is a self-maintaining process that is built progressively and is closely related to the successful implementation of some enabler measures:

- Standardization of products and processes;
- Reduction of transaction costs;
- Anonymity of transactions;
- Transparency of market data;
- Reduction of barriers for new market participants;
- Minimization of default risk.

Power exchanges have been emerged, as a benchmark solution, in order to facilitate and organize electricity trading on the wholesale market, by implementing the aforementioned enabler measures. With proper supervision, a power exchange will be trusted by all market participants and all political decision makers given that its objective is to match supply and demand at a fair price (transparent and reliable wholesale price formation mechanism) and ensure that the trades done at the

exchange are finally delivered and paid through a clearing house (financial security) – two critical prerequisites to assure the well-functioning of the electricity market.

Market supervision

An organized market operated by a power exchange is not a market place without rules! On the contrary, a proper supervision has to be set-up in order to make sure that the exchange fulfills its mission which is to provide a reference price, reflecting the market conditions, as well provide sufficient confidence to market players regarding its organization and functioning.

The existence of a power exchange facilitates the task of market surveillance because it can provide a large amount of information that can be used to monitor and assess the functioning of the market. Taking the example of Europe, the European regulation calls for the setup of a market surveillance office in all the power exchanges, working closely with the national and European regulatory authorities (both energy and financial). The market surveillance has to monitor the market functioning, i.e. check if the price reflects the market conditions, any participant has significant power on the price formation or benefits from specific information. It is worth stressing that a proper supervision shall rely on a clear and steady legal and regulatory framework.

Transparent price formation

Wholesale trade of electricity in the Brazilian FCE has historically been done via OTC. The differences between OTC trading and organized markets are listed in Table 1, and the main one come from the price formation which is not really transparent for the former, whereas this is a completely transparent mechanism framed by rules for the latter.

Table 1 – Differences between OTC trading and organized markets

	Over The Counter (OTC)	Organized Market
Products	Tailor-made	Standardized
Negotiation	Phone Electronic platform Relations	Electronic platform Anonymity Market rules
Transparency	No	Yes
Security	Transactions not secured	Transactions totally secured

As trades on OTC markets are not secured, each trading entity will only accept trades of specific preselected counterparties for which it has assessed the credit risk to be acceptable. The amounts tradable and the economic terms for any given trade may vary with each counterparty. Thus a general price reference will either not exist or not be applicable for all trading entities.

This is avoided in the environment of organized markets through the use of a Central Counterparty (CCP) that represents the same risk-free counterparty for every trade and every counterparty forming the basis for a universally applicable price reference.

In terms of timeframe, organized markets offer standard products for the short and long-term horizons with different durations and delivery (e.g. daily, weekly, monthly, quarterly several years).

- Short-Term Contracts (spot market): products with immediate delivery or in a short period of time, e.g. products “day-ahead” and “intraday”, “week-ahead and “intraweek”.

- Long-Term Contracts (derivatives): products with promise of future delivery at a specified price.

Short and long-terms markets meet different needs and they are complementary markets. While short-term contracts are mostly used to hedge volume risk, long-term contracts are used to hedge price risk and to induce investments to assure the security of supply.

Investment decisions rely on the confidence in the market structure and price formation. It is worth to pointing out that long-term price reference depends on reliable short-term price formation. Thus, a reliable price reference should be constructed under a bottom-up approach, from short term (as close as possible to real-time) to long term. In this market-based approach, trades resulting from a large, open and transparent competition between market participants reflect the best information available at time on the market conditions – the so called price discovery process.

Financial security

Financial contracts are always vulnerable to default risk. In order to improve the financial security, the transactions in the power exchange are settled by multilateral and centralized clearinghouses that become the CCPs in all transactions.

Central counterpart clearing is beneficial for the individual traders and also for the stability of entire market and minimize the likelihood of negative impacts on the wider economy. Its procedures reallocate the risks associated with trading from those who bear them at high costs to those who bear them at lower costs.

The clearinghouse takes the obligations of the buyer (to pay for the electricity) vis à vis the seller, and of the seller (to deliver the electricity) vis à vis the buyer. As a result, individual buyers and sellers are indifferent to the creditworthiness and performance risk of those with whom they deal. This is an essential prerequisite for anonymous trading.

To assure participants that the individual risk of their counterparty is completely eliminated, CCPs operate a system for securing all transactions. These systems are internationally standardized by regulation, such as the European Markets Infrastructure Regulation, the US Dodd-Frank Act or the Recommendations for Financial Market Infrastructures of the CPSS-IOSCO.

The conformance to those standards gives trading participants assurance of the utmost credit quality and will correspondingly eliminate access restrictions or capital burdens for counterparties.

The clearinghouse controls credit and performance risk by evaluating and monitoring the creditworthiness of the respective counterparts. Above certain minimum requirements, the CCP's risk assessment is independent of the quality of the respective counterpart and of its credit rating since the only criterion for the risk assessment is then to collect margins from trades to cover the CCP's estimation of potential close-out costs, delivery or payment risks. Multilateral netting across multiple parties typically reduces collateral requirements as each trader needs only to collateralize the net position at the clearing house instead of each gross position with each individual counterpart.

Furthermore as payments and collateral requirements are calculated and instructed by an independent entity, the speed of payments and level of collateralization can be greatly improved by eliminating disputes and improving overall settlement efficiency through straight-through processes and various legal benefits that are only available to licensed CCPs. Required collateral is further reduced in most clearing houses through the operation of a joint default fund to which all clearing members contribute which covers the risk of extreme market conditions.

As a result, the clearinghouse effectively guarantees contract performance and standardizes the risk of default, relieving the market participants from the need to investigate the creditworthiness of those with whom they trade.

From the point of view of competitiveness, the replacement of the bilateral counterpart credit risk for the clearing solution favors a greater number of market participants, since they may interact anonymously with each other with greater confidence.

2. … TO SMOOTH MARKET FUNCTIONING

In Brazil, the free market was created more than one decade ago and plays an important role in the Brazilian Electricity Market. Nowadays the free market has more than 2,200 agents and represents 26% of total consumption and this participation can reach 46% of the total market, considering the current eligibility criteria. However, transactions in the free market are almost 100% OTC, lacking of liquidity and transparent price formation.

Due to the relevant participation of the free market in the Brazilian Electricity Market, it is important to provide to this environment good price reference and appropriate risk management mechanisms. These conditions will reduce uncertainty and increase the confidence of investors in making long term decision.

Organized marketplaces with standardized products cleared and settled by central counterparts are a critical success factor to build a Smart Brazilian Electricity Market.

A power exchange provides a market place where exchange members send their orders to buy or sell electricity in determined delivery areas. Its role consists in matching these orders in a transparent manner, according to the public exchange rules which among others describe the priorities and algorithms used for the matching of the orders. As a result of the order matching, the exchange produces trades which are legally binding agreements to purchase or sell a determined quantity of electricity to a defined delivery area for the cleared price. This price is never higher than the purchase price fixed by the buyer or lower than the sale price offered by the seller.

The trades are immediately transferred to the CCP, the clearinghouse, which becomes the counterpart to the buyer and to the seller who do not know each other. The CCP takes the obligations of the parts and calls for the money pertaining to the trade from the buyer and hands it over to the seller. The trades are also nominated to the relevant entity responsible for imbalance settlement on the power system where the delivery takes place (CCEE, in the Brazilian case).

This process guarantees:

- fair and orderly execution of the orders of the exchange members,
- secure delivery and payment of the trades,
- anonymous transactions.

The straightforward processes implemented by power exchanges, from trading to delivery and payment, ensure that the price calculation is handled in a transparent and accepted manner, sustaining that matched quantities of demand and supply are the highest as possible. Prices quality increases with the growth of liquidity: the higher the trading volume and the number of active participants, the better prices represent the current market situation and the greater the confidence in the market.

Liquidity gathered by the power exchanges is the key input to produce sound market reference prices, as shown in Figure 2. Furthermore, relying on market liquidity, the price quality prevents also extreme price volatility which would not be justified by market conditions.

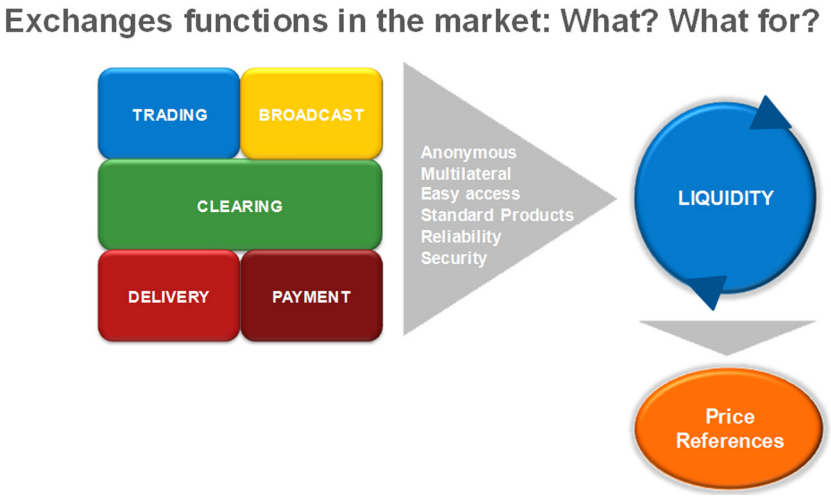

Figure 2 – Exchange functions

A transparent price formation mechanism provided by the exchanges and financial security provided by the CCPs allow a smooth functioning of the markets, shown by the following features.

Admission process

To become a member of an organized market, a company needs to fulfil some requirements and signs some agreements with the power exchange, the clearing house and the market or system operator. This is highly important to make sure that the market participant owns all the required financial means and has the solvency to financially settle its trading engagements.

This shall be also the duty of a power exchange that a company willing to trade on its markets has all the necessary qualifications to do it and check the reason why it wants to trade. This is to avoid any future misbehaviour which could impact the price formation. Given that all members participate in the price formation process, it is necessary to know the trading community.

Security of the transaction

Standardization of products as well as trading and clearing solutions is also of utmost importance for market participants. Actually, standardization decreases quite dramatically the operational risk for the market participants' front and back-offices. For instance, with standardized products, the risk to make a mistake on the submitted quantity or price is low in comparison with non-standardized products where one has also to check, for example, the specific maturity of each product. This is the same regarding the trading platform: while using a standardized platform, the submission of orders can be prepared in advance and directly integrated in the trading platform via standard protocols. This contributes to decrease transaction costs to trade on an organized market.

Reference price largely broadcasted

In most of the power markets in the world, the day-ahead reference price is of great importance for the whole power market. Currently, this reference price is built via a daily auction, which is a pool of liquidity, and given this reliability in its formation, is used by other markets.

Since the day-ahead price is also used for the settlement of futures contracts, indexing long term contracts, a daily reference is a prerequisite to develop a derivative market. Also, one can note a quite close correlation between the day-ahead price and the intra-day index and the price of the imbalance market.

Support competition on the wholesale and retail markets

Electricity is an essential good in our society. The aim of power market opening is to create a fair market which achieves security of supply, competitive prices and services for the free consumers. In this market, a growing variety of enterprises organizes the production, the trading, the marketing, the transmission and the supply of electricity, respecting appropriate regulations. Producers compete to sell energy at the best possible price. Final consumers and retailers which deliver electricity to the final consumers buy the energy on the wholesale market from the producers or other trading companies.

The variety of the market participants has lead to the development of a variety of products and markets with different maturities, which are complementary to meet the needs of the market community. The markets and products proposed by the power exchanges fully participate in the competition on the wholesale and retail power markets.

Risk management and imbalance security

Organised markets are central places where market participants can optimise their portfolio on the short and long run and adjust their position on the short run especially in case of unplanned events affecting the availability of generation capacities or increasing the consumption.

Within the framework of a central dispatch organised by ONS, a flexible and well-organized market allows market participants to balance their position and thus mitigate the risk of a global contractual imbalance on the whole system, which could not be financially settled, due to its unexpected volume or prices.

Having an imbalance price (the PLD, in Brazil) calculated close to real-time operation (such as day-ahead) together with an organized market providing products to hedge against the risk of imbalance (both volume and price) will be a valuable step to reinforce the security of the Brazilian power system both in term of dispatch but also financial risk mitigation.

3. ACTION PLAN

The question is now how to facilitate such evolution towards a more competitive market design, allowing quality of price formation, financial security and general competitiveness.

Based on the best practices adopted in international electricity markets, the following action proposals may give first indications of what could be necessary in order to achieve a truly smart Brazilian Electricity Market. CCEE and its partners EPEX SPOT and ECC AG are looking forward to debating around these actions with Brazilian authorities and market participants.

Proposition 1: Get the PLD closer to real-time operation
The optimization of the central dispatch relies on weekly scheduling adjusted on a daily basis. The technical and economic dispatch organized by the Electric System National Operator - ONS relies on system conditions which are not at present reflected by the PLD calculated on a week-ahead basis. Actually, in case of unplanned events affecting the power system (grid, generation capacity outages), this is not considered in the PLD and the costs are wheeled to the final consumers grid as side payments.

Without questioning the minimum cost pool model, the PLD shall be calculated on a daily basis for two reasons: more accurate representation of system conditions avoiding side payment and support the development of a day-ahead contract market.

In the electricity sector, the shift towards day-ahead markets has further improved the competitiveness of the electricity market. This has facilitated the emergence of reference prices that send the most relevant price signals for investments and indexes for financial derivative power markets.

Proposition 2: Develop products to smooth the market functioning
The development of new products traded on an organized market offering clearing solutions is a very interesting manner to increase the reliability of the functioning of the wholesale market.

The launch of an organized market shall follow a step-by-step approach in coherence with the progress achieved with making PLD closer to real-time. Actually, this development will consist of the launch of futures contracts whose maturity could be the week, in a first stage and complemented then by month and even year. Shorter maturities could be only envisaged if the PLD is calculated on a shorter term.

Proposition 3: Implement clearing solutions
The introduction of central counterparty clearing enables the reallocation of this risk such that the trader is protected against counterpart defaults. Central counterparty clearing, assumed by a clearinghouse, shall thus be implemented in order to mitigate the risks associated with trading, and to guarantee an orderly function of settlement, payments and deliveries.

This is achieved by different activities and services executed by the clearing house. Those include the monitoring of the participants' activities and financial situations as well as netting of payments and opposing energy futures positions. Further important processes are the collection of collateral to cover losses in the case of a default and daily valuations of open positions via mark-to-market in order to ensure adequate collateralization at all times. For payments and deliveries, stable and reliable processes with the relevant Brazilian institutions shall be implemented.

OTC trading and organized markets are complementary tools for market participants. The standardization of OTC contracts is a first step to allow the implementation of a clearing service for the OTC trading. With respect to the size of the Brazilian electricity market and the present volume of OTC contracts, a standardized clearing solution combining exchange, OTC trades and the imbalance market could be highly valuable for the market participants. Actually, this will reduce their financial risk exposure while securing the market as a whole.

Proposition 4: Clear separation of wholesale and retail market and incorporating demand response
Wholesale markets are arranged into energy, transmission congestion and ancillary markets. The wholesale energy market consists of forward markets and short-term markets like day-ahead and real-time markets. The supply side of the wholesale market is represented by centrally dispatched generators while load served entities (regulated distribution companies or retailers) and big consumers are the demand side, being also the main source of demand response in the wholesale market.

Economic incentives to separate wholesale and retail participants are a critical path to support an efficient implementation of demand response programs, given that these programs differ for wholesale and retail markets. For the wholesale market, it is important to introduce demand-side bidding in the scheduling to achieve a transparent price formation process, in order to reduce price spikes and avoid high cost generation. However, the cost associated with this approach is not suitable for small size consumers that nowadays operate in the wholesale market. Thus a clear definition of the wholesale market participants is essential to stimulate demand response in this market.

The way out for small consumers is the retail operation that is nowadays under construction by the Brazilian regulator. A characteristic of retail market is that most consumers are likely to desire price insurance for all of their consumption, paying a market-based premium for this covering, especially if electricity is not the core of their business. This will lead to get prices not differentiated by time period; consequently, there will be little incentive for retail load to respond to wholesale prices. However, some retail customers will decide to accept some wholesale market risk to avoid the insurance premium. Competition among retailers for customers will lead to the development of risk differentiated pricing products, including products that will provide demand response opportunities in the wholesale markets. At one extreme of the retail product spectrum, one could find unhedged spot pricing and at the other extreme, the fully insured guaranteed price product, or perhaps even a fixed-bill product.

Finally, a consistent retail market will add value for the whole electricity market. Retailers, as a load aggregator, will need forward contracts to mitigate price risk and this forward contract need will support investment, contributing to the security of supply.

Proposition 5: Organize market surveillance
For sake of transparency, market operators shall be responsible for monitoring the smooth functioning of the wholesale market. Their duty shall be to check if prices resulting from any market operated reflect the market conditions. This monitoring shall be accountable by the relevant regulatory authorities and regular reporting shall be organized to them.

Prohibitions of insider trading / market abuse together with the obligation to publish "inside information" go hand in hand with the issue of transparency. While the first one is aimed at market integrity and the need of regulators to collect the relevant data in order to fulfill their monitoring function the second one is aimed at creating a level playing field for all market parties by giving them fair and equal access to trading data (e.g. prices and volumes) and fundamental data (e.g. planned electricity production).

The following key points should be considered for a successful implementation of increasing market integrity:

- Compatible regulation of the energy and financial sectors is crucial. Loopholes and regulatory arbitrage resulting in unclear responsibilities should be avoided. In this context, it is crucial to align reporting requirements in order to avoid different standards and double reporting effort.
- While market participants as data owners are legally responsible for data reporting, market operators can help to fulfill these reporting requirements.

The evaluation of an extensive data collection should not be underestimated and could pose a serious challenge to the overall process. Therefore, the possibility should be taken into consideration that not all data are collected by the regulators but that, e.g., orders to trade are only requested on a case-by-case basis.

GLOSSARY

ANEEL
Brazilian Electricity Regulatory Agency - ANEEL, created by Law n.º 9,427 from December, 1996 and regulated by Decree n.º 2,335 from October, 1997. ANEEL's mission is to provide favorable conditions for the electric power market to develop a balance between the agents and the benefit of society.

AUCTION
Procedure for making transactions after a period of time during which the orders entered by exchange members in the order book are accumulated but not executed. The price determination algorithm aims at optimizing the total welfare, i.e. the seller surplus, the buyer surplus and the congestion rent (if applicable).

CCEE
Chamber of Electric Energy Commercialization – CCEE, created by Act 10.848/2001 and established by Decree 5.177/2004, is a Brazilian not-for-profit, private, civil organization company, which purpose is to carry out the wholesale transactions and commercialization of electric power within the National Interconnected System, for both Regulated and Free Contracting Environments and for the spot market, actually having +2,200 agents, among generation, distribution, commercialization and free consumers companies. CCEE is also in charge of determination of the Settlement Price for Differences (spot price) to value the short term market transactions, of execution of the energy accounting process, and execution of electricity auctions within the regulated contracting environment by delegation of National Electricity Regulatory Agency - ANEEL.

DAY-AHEAD MARKET
Part of the spot market where a commodity is tradable one day before delivery.

EPEX SPOT
EPEX SPOT SE operates the power spot markets for France, Germany, Austria and Switzerland (Day-Ahead and Intraday). Together these countries account for more than one third of the European electricity consumption. EPEX SPOT SE is a European company (Societas Europaea) based in Paris with a branch in Leipzig. 170.7 TWh have been traded in the first six months of 2012 on EPEX SPOTs power markets. EPEX SPOT has currently 197 Exchange Members.

ECC
European Commodity Clearing AG - ECC is the central clearing house for energy and related products in Europe. In its function as the central counterparty ECC assumes clearing as well as physical and financial settlement of transactions concluded on APX-ENDEX, CEGH Gas Exchange of Vienna Stock Exchange, EEX, EPEX SPOT, HUPX and Powernext or registered for OTC clearing on these exchanges.

CLEARING HOUSE
An institution which acts as a central counterparty for transactions - CCP. The clearing house organizes the accounting of receivables and liabilities, the delivery and the collateralization of the transactions.

ONS
Electric System National Operator - ONS is an entity of private right, non-profitable, created on August 1998, responsible for coordinating and controlling the operation of generation and transmission facilities in the National interconnected Power System under supervision and regulation of the National Electricity Regulatory Agency - ANEEL.

ORDER BOOK
Centralization by the Trading System of buy and sell Orders and ranking based on the execution priority determined by the matching algorithm.

OTC
Abbreviation for “Over-The-Counter”. An OTC contract is a bilateral contract in which two parties agree on how a particular trade or agreement is to be settled in the future.

OTC CLEARING
Service offered by exchanges. OTC transactions which correspond in their contract specification to exchange transactions can be registered. In this case clearing and settlement of the OTC transactions will be done by the respective clearing house.

VOLATILITY
Volatility is a measure of the price fluctuations in the course of one day.