



# Antuko Power Analytics

Marginal Cost | CHILE  
Local Marginal Price | MEXICO  
Daily Market Price | SPAIN

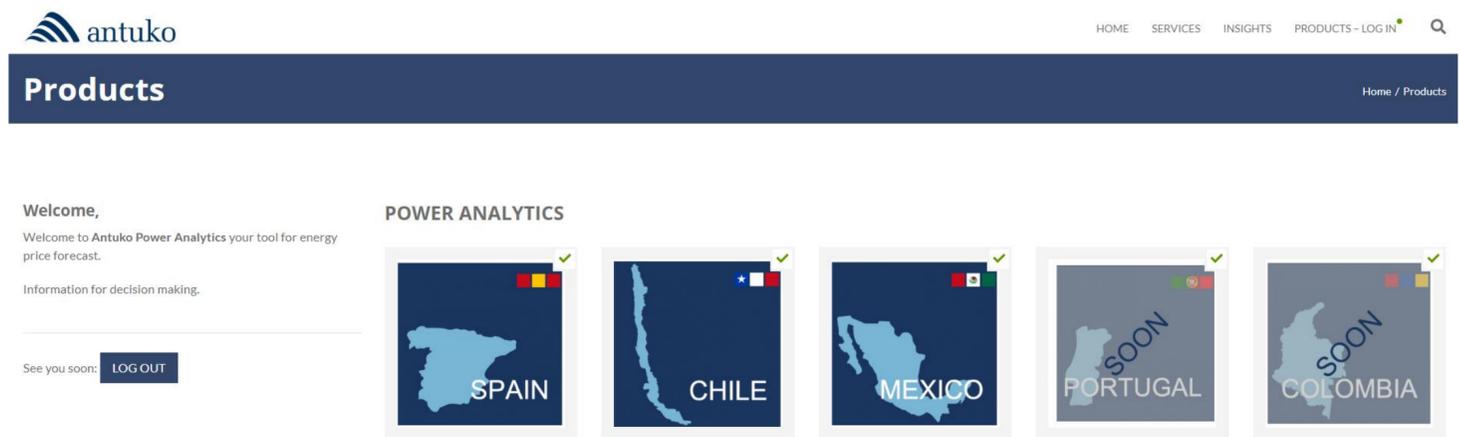


# Antuko Power Analytics

**Antuko Power Analytics** is a web-based platform developed by Antuko to cover the need of having permanent access to updated energy price forecasts required to take sound investment decisions.

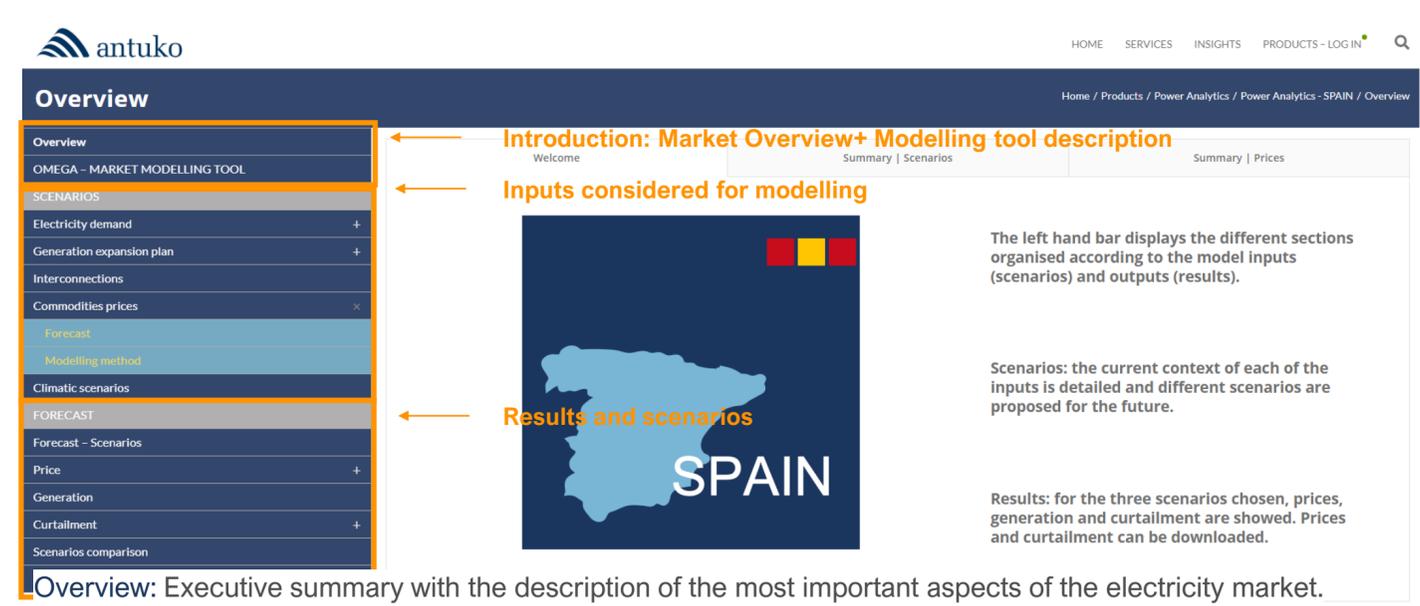
The **APA** platform provides, through web access and immediate download, projections of Marginal Costs and Stabilized Prices (Chile), Daily Market prices (Spain), and Local Marginal Prices (Mexico) in the long-term (until 2040).

With an user-friendly design, the inputs and the results are available to the Cliente on a monthly-updated basis, ready for download.

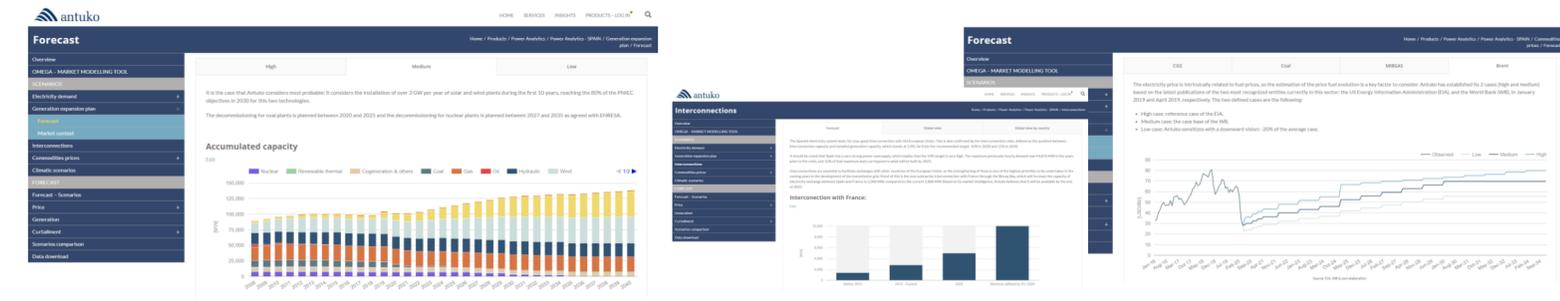


This platform considers three modelling scenarios\* (High, Base and Low) which provides a complete overview of market prices.

**Power Analytics**, our proprietary online platform, gives the Client permanent access to a day-to-day updated long-term price projection report.



- Overview:** Executive summary with the description of the most important aspects of the electricity market.
- Demand:** Description of the assumptions of the energy demand model: Expected growth in demand, EV growth, and self-consumption, based on public studies, and own studies.
- Generation Expansion Plan:** Plan for the installation and dismantling of the generation assets (based on Antuko's specific knowledge on the development stage, contracting the sale of energy for the projects and / or financing).
- Transmission and Interconnections:** Description of the development plan for the transmission infrastructure taking into account new expansion needs (international interconnections).
- Commodities:** Commodities price forecast (based on the World Bank and EIA).





The Chilean power sector is highly complex given its technical, economical and regulatory conditions. This produces a degree of uncertainty at project development financing and operational stages. Therefore, a power price forecasts becomes relevant to developers and financiers as it allows to partially mitigate such uncertainty. Generally, some of the complexities are as follows:

### Economical

- High dependency of fuel prices and availability given its hydro-thermal dominated energy-mix.
- Demand strongly linked to economic cycle given that more than 50% of total demand is explained by private customers (industries and mining activities);
- Increased penetration of renewable energy at competitive costs.
- Public policy supporting international electricity tenders increasing competition in the market.

### Technical

- SIC and SING interconnection accomplished and last section of Cardones-Polpaico transmission finished.
- Transformation of the transmission business through the new transmission regulation (“Ley de Transmission 20.936”) which created an independent organism coordinator for the SEN.
- New regulation since March 2016 for capacity and ancillary services markets under law DS62.

### Regulation

Several regulations, that require deep understanding of current and future market behavior, are in elaboration and/or under discussion like ancillary services, storage usage, flexibility strategy, capacity recognition methodology and a new Decree that will be change the methodology of calculation of Stabilized Price for PMGD projects.

### Our Tool

Antuko has built its generation and marginal cost forecasts with the model used by the system operator to determine the efficient use of water in reservoirs and the optimal dispatch of the available power plants. This model, known as PLP (Programación de Largo Plazo) permits modelling a multi-reservoir and multi-nodal system, which allows the focus to be placed on hydrological variability and the local level of supply-demand equilibrium, while considering the effect of transmission limitations.

### Marginal Cost forecast

To forecast long term Marginal Cost, for the SEN (National Electric System), Antuko will use the PLP tool to optimize the system dispatch and minimize the overall cost of operation in a 15 years horizon. Antuko’s model will be based on hypothesis on the future evolution of the following market drivers:

Electricity demand growth considering the Demand forecast issued by CNE on January 2020 complemented with Antuko’s knowledge, related with private demand (Transport, Infrastructure, Desalinization and Mining projects) taking into account, among others, sources like COCHILCO, SEIA, and reports issued by the Economy Ministry. World Bank and Energy Information Administration (EIA) forecast for the prices of fossil fuels (Brent, HH LNG gas and coal).

Generation expansion plan (based on Antuko’s specific knowledge on the status of development, financing and construction of each Project in the medium term and assumptions on future tenders awarding). Transmission expansion plan (based on CNE data and includes Antuko’s specific knowledge on actual progress). Expected hydro scenarios for the following 15 years on the basis of Antuko’s interpretation of the historical trends in the CEN data including.

Although our models consider a 15-year time horizon, Antuko is able to extrapolate the results to complete the time horizon to years 16 to 20. After that period, the uncertainty in Market assumptions (technical, legal and economical) is high and results may suffer important variation from what can be forecasted. That being said, for the financial model flows, we suggest to use the values of the year 20 for the years 21-35.

### Capacity forecast

In order to forecast the Capacity Stabilized Price in the node of interest, Antuko will consider the following:

- The CNEs base price of Power for the Reference node, which is determined on the basis of the price that makes a 70 MW back-up generation unit economically viable at a 10% return requirement.
- Antuko’s forecast of the power capacity penalization factor in the nodes of interest on the basis of the ratio of marginal costs between that specific node and the reference node.

In accordance with the Decreto Supremo 62 (DS 62), all generation units are entitled to some recognition of their contribution to the capacity sufficiency of the system. In this context, the procedure established by the CEN allows renewable generation units to accrue capacity revenues. Antuko will project monthly capacity revenues for the project(s) of interest until 2034.

For this purpose, Antuko will forecast the capacity that is recognized by the CEN to each unit. This involves the development of a full market model that considers the same supply and demand growth assumptions of the above-described market modelling and calculates:

- (i) initial power capacity and preliminary power capacity of the generation unit considering its specific operational characteristics.
- (ii) total capacity sufficiency correction factor (“Factor Único”), which is defined as a percentage of maximum demand on the sum preliminary power capacity.



# Mexico

The Mexican power sector is highly complex and dynamic given its technical, economic, and regulatory conditions. For developers and financial institutions, these situations represent a significant degree of uncertainty that can be mitigated using power price forecasts and analyzing the system mechanics. Under this context, the key elements to consider are:

### Economical

A fast-paced electricity demand growth, associated to the GDP and the imminent electrification, where Mexico stands as the OECD country with the lowest consumption of kWh per capita. The large impact of fuel prices on Mexico's thermally-dominated energy mix, combined with an increased penetration of renewables at competitive costs.

### Technical

Mexican geography and its population centers dispersion represent challenges, that despite its vast interconnectedness, suffers from congestion and price decoupling in diverse regions of the country. Fast-paced, high-volume growth in generation capacity holds the potential to create negative energy prices due to congestion.

### Regulatory

The Energy Reform is still in progress and several key operating rules, products, and roles have not yet been fully established and understood.

In addition, the new Federal Government has sent crossed signals in the form of both official publications and media announcements regarding its support to the Energy Reform and the role of renewables in the energy system.

### Our Tool

Antuko uses PLEXOS, an online platform that determines the optimal operation programming of an electrical system in a mid-term horizon:

- It is structured around a number of elements such as: thermal, hydro, and renewable (solar PV, wind, CSP, batteries) power stations, busbars and grid transmission lines, dams, flows, filtration and other limitations of the hydro network.
- Its algorithm guarantees that each element is operated in such a way that it satisfies the requirements of basic energy balance and flow equations.
- The grid representation includes energy loss due to transmission into the total system cost.
- There are three types of system restrictions in the model: energy balance, hydro balance, and the fulfilment of Kirchhoff's laws (voltage and current equations).

The result of all this is a model that represents the operation of an electrical system with several geographical divisions joined by physical and economic factors.

### Local Marginal Price forecast

To forecast the Local Marginal Prices (PMLs) for the SEN (National Electric System), Antuko uses PLEXOS, an online platform that optimizes the system dispatch and minimizes the overall cost of operation in a 15-year horizon. Antuko model is based on hypothesis on the future evolution of the following market drivers:

The mechanisms that fix the Local Marginal Prices (PMLs) and key assumptions regarding future evolution and impact on future prices. Modeling responds to a system expansion scenario expected by Antuko, including assumptions about the evolution of the following variables:

Expected demand growth (based on Antuko-adjusted PRODESEN data); Current generation mix considering the specifications of each technology; Generation and Transmission Works Plan, which includes the new power plants and transmission lines that will enter operation, as well as the ones to be withdrawn, based on public information and Antuko market intelligence; Three projected price scenarios for fuel prices, including Natural Gas but also considering other relevant fuels, using information from the World Bank and the Energy Information Administration; Three expected hydrological scenarios based on historical data from the last 11 years.

The modeling considers the 3 components of the PML (energy, losses, and congestion), delivering the final result of the interaction between these in hourly resolution on a 15-year horizon. The results, including PML and system expansion, are presented using a Base Case, defined by Antuko, as well as two additional cases (High & Low).

### Power forecast

In order to guarantee the supply of electricity in SEN even in the hours of high demand or few reserves, Mexico has created a Balance of Power Market defined by a series of laws and regulations.

One of the key elements of the market is the definition of the 100 critical hours which change according to the year in question. In this context, a Power Plant is entitled to the recognition of its contribution to the Capacity of sufficiency or Power of the system during these 100 critical hours, as determined by the CENACE.

Based on the definitions of this power market, Antuko forecasts the 100 critical hours, as well as the associated market prices and volumes using our own generation system modeling. Specifically, Antuko uses its projection of the Generation Mix to determine the availability of the generation system and its projection of the demand to evaluate the need for power.

Antuko uses its projection of the 100 critical hours to determine the Capacity (MW/yr) to be recognized for the Project as well as its associated income.



# Antuko Power Analytics

Spain

To understand and model the OMIE Daily Market, the following data were processed:

- The hourly generation data of about 4,000 physical units,
- Grouped in about 1,600 units in OMIE,
- Analyzing their movements in the 15 market,
- Adding then +22,000,000 records analyzed per year (equivalent to more than 2,500 records/hour).

The detailed analysis of all this information allowed us to understand that a classical electricity market modeling tool was not enough to represent the operation of the Spanish Daily Market.

Based on our own sophisticated forecast model, and a deep knowledge of the variables that interfere in the formation of daily market prices, we are able to deliver long-term, solid, reliable and bankable daily market price projections in international markets.

The price forecast implies a broad knowledge of various variables, both economic and market, such as electricity demand, the additions to the generation fleet and dismantling plan, renewable resources, climatic variables and commodity prices, among others.

- Likewise, the new market outlook raises other questions, such as:
- What will be the effect of strong renewable penetration?
- Breakthrough of storage? How will transmission capacity be affected?
- How will the dismantling of the conventional generation take place?

### Our Tool

Antuko developed its own tool, OMEGA, mixing fundamental, physical modelling, and the strategic behavior of market agents.

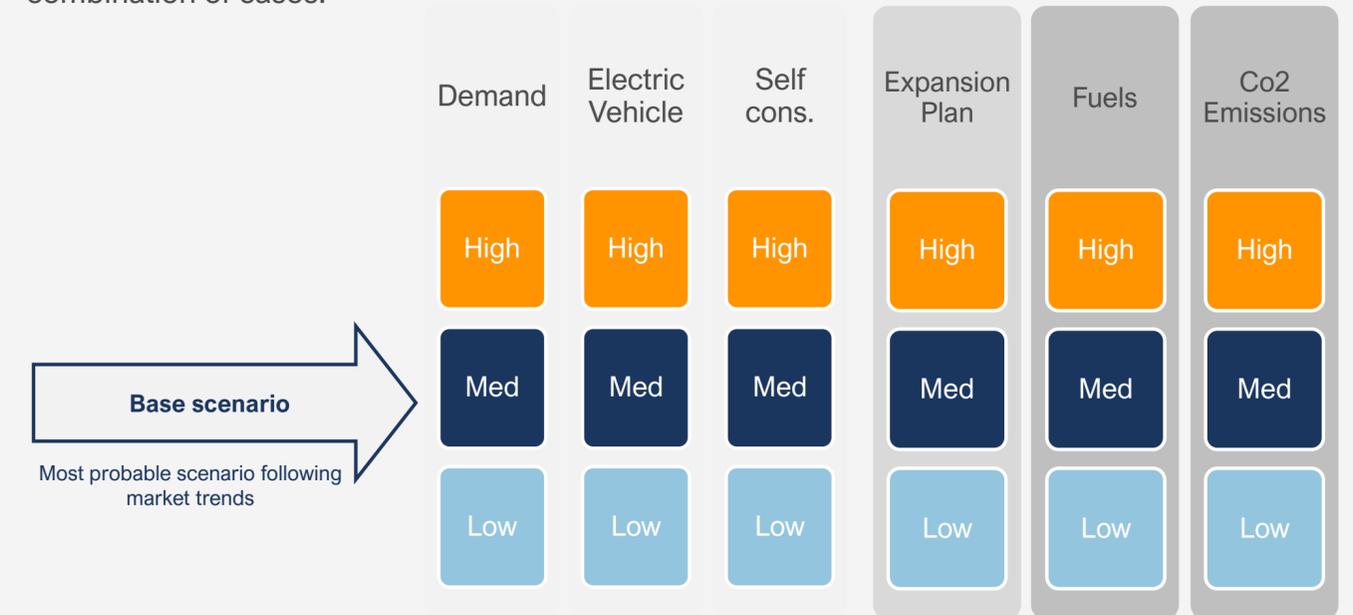
OMEGA is a modeling tool for electrical markets, developed by Antuko to be able to model the offer markets, such as the OMIE Daily Market in Spain.

OMEGA is based on a classic model of electrical dispatch, hydrothermal coordination type with operational restrictions. To this classic model is added a strategy model to reproduce the behavior of market agents.

OMEGA allows to work with hourly resolution, in the long term, with any number of scenarios mixing demand growth, generation expansion plan, commodity prices, among others.

### Daily Market Price forecast

The description of the results of the forecast of prices, are based on three scenarios constructed as a combination of cases:



This allows us to deliver, in a permanently updated way, a complete market forecast: Prices 24/7, Solar / Wind Sale Price, curtailment until 2040, annual, monthly resolution, for the base scenario and the 2 sensitivities 2.

# Antuko Power Analytics

# Deliverables

- Price Report
- Forecast (annual, monthly and daily forecast) :  
System Global+ selected nodes  
Capacity  
Other products



Instant Download

## Kick-off meeting with the Client.

Within 15 days after subscribing to Power Analytics, a kick-off meeting will be organized, in agreement with the Client, to explain the operation of the platform, its inputs and downloadable content (90 minutes).

## Deliverables (Downloads)

The results available through Power Analytics will be available to the Client through the same platform, ready for download, automatically using .csv files.

The updated descriptive report of the inputs and considered assumptions will be available for the Client through the same platform, by downloading a PDF file.

## Follow-up with the Client

Quarterly, in agreement with the Client, an update meeting will be organized to review those inputs that have been updated in the quarterly period, together with its impact on results (90 minutes).

## On- going Q&A

Each subscription considers a six- hour Q&A package, in order to clarify any doubts related with the inputs and price updates.

Results available to visualize and download, y annual, monthly and hourly resolution, for the base case and two sensibilities:

Forecast results (XLS) for each market and node(s) subscribed

Full Price Forecast Report (PDF) for each market subscribed

- General decrease in MD prices from 2020 to 2024 due to the commodities update in the short term.
- Sensitivity 1: the decrease until 2024 (incl) come from self-consumption, which reduces demand, and the sharp increase observed in 2025 corresponds to the change in the reference commodities. This change from future markets short term reference to EA reference increases in average 16%.
- Sensitivity 2: the sharp increase observed in 2025 in Q4-2019 disappear in Q1-2020. The last exit of the nuclear plant continued in 2025; however the demand does not increased so much thanks to the self-consumption (input that was modified respect to the previous base), this new demand level allowed to reduce the use of "responsive" hydro and therefore the prices do not rise as much.



FEES

# Antuko Power Analytics

# FEES



## Chile

USD 990/month

**Base Fare:** Long term Marginal Cost in the six representatives' nodes of the SEN (Crucero 220, Cardones 220, Pan de Azúcar 220, Polpaico 220, Charrúa 220, Puerto Montt 220) in a monthly-hourly resolution for the Base scenario and High case and Low case.

**Additional 1:** Stabilized Price (up to 5 nodes chosen by the Client)\*

+ USD 400/month

**Additional 2:** Capacity prices

+ USD 350/month

**Additional 3:** On demand generation profiles

+ 100 USD /month



## Mexico

USD 1,125/month

**Base Fare:** Local Marginal Price forecast on a monthly-hourly resolution for the Base scenario and 2 sensitivities (High case and Low case). Includes 9 reference nodes of the SEN as well as the Energy Component of the SIN (Queretaro Potencia).

**Additional 1:** Capacity Price

+ USD 375/month

**Additional 2:** CEL Price

+ USD 263/month

**Additional 3:** Additional nodes, as requested by the Client

+ USD 75 /month



## Spain

EUR 990/month

**Base Fare:** 24/7 Daily Market Price forecast, annual, monthly resolution, for the base scenario and 2 sensitivities (high case and low case).

**Additional 1:** Solar Price+ curtailment

+ EUR 150/month

**Additional 2:** Wind Price+ curtailment

+ EUR 150/month

**Additional 3:** Portuguese price



+ EUR 300 /month

**Subscription:** Annual

**Invoicing:** Monthly

**Access to deliverables:** Web based

**Follow up meetings:** Quarterly update meeting to analyze the new inputs considered and the effect on results.

**On- going basis Q&A:** Six hours package to attend questions related with inputs and price updates (per subscribed market).

### Further information

**Chile:** [chile@antuko.com](mailto:chile@antuko.com)  
**Mexico:** [mexico@antuko.com](mailto:mexico@antuko.com)  
**Spain:** [spain@antuko.com](mailto:spain@antuko.com)



Understanding power markets