

# ECUADOREAN POWER SECTOR

## Regulatory framework and Power Market outlook

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# ECUADOREAN POWER SECTOR. REGULATORY FRAMEWORK AND POWER MARKET OUTLOOK

## 1. FOREWORD

This document presents a brief description of the Ecuadorean power market and its regulatory framework.

### Remarks

In 2021, the Ecuadorian government has started a bidding process for the acquisition of new generation capacity including renewable and conventional technologies: 500MW of NCRE and 400 MW of natural gas-fired combined cycle. The whole process will last 6 months, including a Q&A period at the beginning of it and finalizing with the investors' offers.

Similar bidding processes have been taking place in other countries of the region such as Argentina, Chile, Peru, Brazil, Panama, Mexico, where we have been able to actively participate advising private investors and potential lenders on the opportunities and risks associated with the energy market environment.

We understand that due to its physical and regulatory characteristics, the Ecuadorian electricity market has particularities that should be analyzed in detail as part of the decision-making process on possible investments.

In summary, this technical note is aimed at providing initial information on the Electricity Sector of Ecuador for business evaluation. We consider it to be the first step to the assessment of the market's possible future dynamics and the identification of potential risks and mitigation actions.

This document reflects GME's professional judgment based on accepted standards of professional investigation and, as applicable, the data and information available in the public domain.

In line with those accepted standards, this document does not in any way constitute or make a guarantee or prediction of results, and no warranty is implied or expressed that the actual outcome will conform to the outcomes presented herein.

The opinions expressed herein are subject to the generally accepted uncertainties associated with the interpretation of engineering and commercial data and do not reflect the totality of circumstances, scenarios and information that could potentially affect decisions made by the report's recipients and/or actual results. The opinions and statements contained in this report are made in good faith and in the belief that such opinions and statements are representative of prevailing circumstances.

## 2. ECUADOREAN ELECTRICITY MARKET

Ecuador is the seventh largest electricity market in Latin America in terms of generation installed capacity (8,689.2 MW, Dec 2020), 58% corresponds to hydroelectric plants, 39% to thermal plants and 2% to non-conventional renewables (mainly biomass).

In 2020 Ecuador's demand in the SIN was 24,580 GWh, with a peak annual demand of 3,933 MW.

The National Interconnected System (SIN in Spanish) contains 84% of total installed capacity, the remaining 16% are spread in many isolated systems including wellhead and Galapagos island systems.



## 3. REGULATORY FRAMEWORK

In 1996, the Government of Ecuador, under the new Electricity Sector Law (LRSE), reformed the power sector including the privatization of the *Instituto Ecuatoriano de Electrificación* (INECEL). The privatization of INECEL and the unbundling of the different activities was part of a broader reform program that involved establishing a new regulatory framework, introducing a wholesale electricity market and adopting a new tariff scheme.

On October 20<sup>th</sup>, 2008, Ecuador implemented a new Constitution, replacing the previous one approved on 5 June 1998. In accordance with Article 14, the new Constitution stated that the government is responsible for the provision of power energy based on the principles of obligation, generality, uniformity, accountability, universality, accessibility, consistency, continuity and quality. It also establishes that the State shall set fair prices and tariffs for public service, and establish control and regulation.

The new Constitution establishes that the law will define the participation of companies in which the State shall always have the majority shareholding for the purpose of managing strategic sectors and of the provision of public services. The State may, exceptionally, delegate the execution of these activities, established by law, to private companies and to popular-and-solidarity economy entities<sup>1</sup>.

### Main changes introduced by Constituent Mandate N° 15:

- Migration from a marginal cost-based system (1996-2008) towards a regulated cost system.
- The State performs the expansion of the generation, transmission and distribution system. Furthermore, the Mandate explicitly states that the participation of the private sector will decrease, with participation only in exceptional cases.
- Promotion of a new tariff regime for distribution companies with a unique tariff.
- Any difference between generation, transmission and distribution costs and the tariff determined for distribution's end users will be subsidized monthly by the National Budget.
- Investment for transmission and distribution will be financed through the National Budget.
- Contracts will be regulated between generators and distributors and freely negotiated between generators and large consumers.
- The rural and marginal urban electrification regimes (FERUM) are financed through the National Budget.

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<sup>1</sup> Popular-and-solidarity economy entity is an economic organization in which members, individually or collectively, organize and develop processes of production, exchange, marketing, financing and consumption of goods and services to meet needs and generate revenue. They are based on relationships of solidarity, cooperation and reciprocity, giving priority to the work and humans, in harmony with the nature over appropriation, profit and capital accumulation.

The wholesale market is thus concentrated in a contract market at regulated prices among generators and distributors to supply regulated users and, in a smaller proportion, contracts among generators and large users at freely agreed prices. Transactions at the spot market are reduced only to adjust differences between the long-term regulated contracts.

Since 2015, the new Organic Law of Public Electricity Services (LOSPEE or Ley Orgánica de Servicios Públicos de Energía Eléctrica) rearranges the institutional framework and promotes the use of renewable sources to generate electricity.

## Market's main institutions

The main institutions are the Ministry of Energy and Renewable Resources (MEER in Spanish), the regulatory agency, the system operator (CENACE) and the Ecuadorean Electricity Corporation (CELEC EP), which comprises 13 business units (12 generation companies and 1 transmission company).



The **Ministry of Energy and Renewable Resources (MEER)** is responsible for power sector planning, renewable energies and energy efficiency. The public sector and the private sector are required to comply with the following instruments:

- The National Electricity Plan (Electricity Master Plan).
- The National Energy Efficiency Plan (Electrification Master Plan).

MEER is also responsible for granting the “Operation Authorization” and for awarding contracts.



The **Electricity Regulatory and Control Agency (ARCONEL in Spanish)** is in charge of:

- Regulates the technical, operational and economic aspects of the public electricity service and issues the rules that must be complied with by the agencies of the electricity sector.
- Monitors compliance with the standards and obligations derived from the enabling titles.
- Establishes the tariffs for electricity services.

Before the creation of **ARCONEL**, **CONELEC** was in charge of being the regulatory agent of the Ecuadorian electricity market. It should be clarified that there are still **CONELEC** resolutions in force that are administered and supervised by **ARCONEL**.



The **system operator (CENACE)** acts as the technical operator of the SIN and as the commercial administrator of the financial transactions, including responsibility for the continuous supply of electricity at a minimum cost, while ensuring the overall efficiency of the sector.



The “**Ecuadorean Electricity Corporation, Public Company**” (**CELEC EP**) is a public company responsible for generation and transmission in Ecuador.

In January 2010, the former **CELEC SA** Company became a state strategic society under the name of “**Corporación Eléctrica del Ecuador, Empresa Pública**” or **CELEC EP** by Executive Decree 220/10. Initially in 2009, **CELEC SA** was born from the following firms: **HIDROPAUTE S.A.**, **HIDROAGOYAN S.A.**, **ELECTROGUAYAS S.A.**, **TERMOESMERALDAS S.A.**, **TERMOPICHINCHA S.A.** and **TRANSELECTRIC S.A.**





The **National Electricity Corporation, Public Company (CNELEP)** is a distribution company comprising the following business units: Empresa Eléctrica Esmeraldas SA; Empresa Eléctrica Regional Manabí SA; Empresa Eléctrica Santo Domingo SA; Empresa Eléctrica Regional Guayas-Los Ríos SA; Empresa Eléctrica Los Ríos CA; Empresa Eléctrica Milagro CA; Empresa Eléctrica Península de Santa Elena SA; Empresa Eléctrica El Oro SA; Empresa Eléctrica Bolívar SA; and Empresa Eléctrica Regional Sucumbíos SA, which currently operate as regional departments.

## Generation Dispatch

To supply the demand at the minimum cost, the system operator (CENACE) dispatch thermal generation based on the variable production costs of each thermal unit (fuel cost plus variable O&M cost), declared by the generators. Generators with the minimum variable cost are dispatched first. By the Regulation CONELEC 003/03, the CONELEC periodically audits the variable costs declared by each thermal generator.

In the case of hydro power plants with large reservoirs, CENACE determines a shadow price (called "water value") that is calculated as an opportunity cost to replace thermal dispatch in the future. A hydro power plant is dispatched if its water value is lower than thermal generation variable production cost. A low water value suggests the benefit of using water now rather than storing it for future electricity generation. A high water value means that the system will benefit (in terms of minimizing costs) from water storage to supply the electricity demand in the future.

Run-of-river hydroelectric plants (without significant reservoirs) are always dispatched according to their inflow (zero variable costs). Therefore, the "water value" for run-of-the-river hydro plants is zero.

Similarly, non-conventional renewable based units (solar, wind) are dispatched at zero variable cost. Therefore, together with the run-of-river hydro units, they enter first in the dispatch merit order.

The energy marginal cost (spot prices) results from the economic dispatch and they are equal to the variable cost of the most expensive generator that was dispatched. It does not include operating cost overruns caused by congestions in the transmission network nor the operating inflexibilities of the generation units.

## Long Term markets

### *a) Regulated customers*

To comply with the provisions of **Constituent Mandate Nro. 15**, on July 12, 2008, the existing generators (state-owned or private) were called to sign regulated contracts with all distribution companies, in proportion to the regulated demand of such distribution companies and for the net capacity not committed with large customers.

The regulated contracts signed by the Generation or Self-Generation Companies with the Distribution Companies have a price formula established by the regulation<sup>2</sup> with two components:

- (a) Fixed charge, that considers both the annuity of the investment and the administration, operation and maintenance fixed costs.
- (b) Variable charge, that considers all the variable production costs incurred by the power plant in the production of energy (fuel, variable O&M, etc)

In 2020 the regulated contracts represent 88.8% of all economic transactions, The remaining economic transactions were composed of 10.1% of NCRE contracts signed under public tenders, 0,9% of international transactions and 0.2% of non-regulated contracts.

<sup>2</sup> Regulation CONELEC 013/08 and Regulation CONELEC 004/09

## ***b) Large consumers***

To be qualified as a large consumer, it is necessary to register, during the 6 months before the qualification request, an average maximum monthly demand equal to or higher than 1 MW and minimum annual energy consumption of 7000 MWh in the twelve months before the request (implicit 80% load factor).

As of December 2008, there were approximately 71 large consumers, which was drastically reduced since the application of LSPEE. Today there is only one large consumer.

Large consumers have the possibility of making transactions in the contract market, either through bilateral or import contracts.

Since the supply of generation is mostly owned by the State and these units are forced to sell to distributors as a priority, large consumers have been limited in their ability to sign contracts.

## **Generation expansion**

The Electricity Master Plan (PME) is prepared by the MEER considering a ten-year projection and identifies the generation projects for the electricity sector and its priority. The PME is aligned with the National Development Plan prepared by the National Planning Council (CNP). A fundamental part of the PME is the Generation Expansion Plan (PEG). The last PME issued covers the period 2018 – 2027 but the PEG was updated in 2021 till 2031.

The investment required to execute the generation, transmission and distribution projects of the PME by public entities and private companies, will be charged to the General State Budget and/or through their resources.

Alternatively, for the financing of the projects, public enterprises may contract credits with their own or State guarantees.

## **4. POWER MARKET OUTLOOK**

### **Generation segment**

The following table shows the installed capacity as of December 2020 in ECUADOR. Most of the contribution to the generation matrix comes from hydro and thermal energy with 58% and 39%, respectively.

**Table 1. Country Installed Capacity as of December 2020, MW and %**

Installed Capacity		Continental				Galapagos		TOTAL	
		SIN		Isolated		MW	%	MW	%
		MW	%					MW	%
Renewable	Hydro	5,070.3	69%	6.1	0.5%	-	0%	5,076.4	58%
	Wind	16.5	0.2%	-	0%	4.7	10%	21.2	0%
	Solar	24.5	0.3%	-	0%	17.8	38%	42.3	0%
	Bio	151.6	2.1%	-	0%	-	0%	151.6	1.7%
<b>Total Renewable Energy</b>		<b>5,262.9</b>	<b>72%</b>	<b>6.1</b>	<b>0%</b>	<b>22.5</b>	<b>48%</b>	<b>5,291.4</b>	<b>61%</b>
Thermal	Engine	778.6	11%	1,211.6	91%	24.2	52%	2,014.3	23%
	GT	820.6	11%	101.3	8%	-	0%	921.9	11%
	ST	445.8	6%	15.9	1%	-	0%	461.6	5%
<b>Total Thermal Energy</b>		<b>2,044.9</b>	<b>28%</b>	<b>1,328.7</b>	<b>99.5%</b>	<b>24.2</b>	<b>52%</b>	<b>3,397.8</b>	<b>39%</b>
<b>Total Installed Capacity</b>		<b>7,307.8</b>	<b>100%</b>	<b>1,334.8</b>	<b>100%</b>	<b>46.6</b>	<b>100%</b>	<b>8,689.2</b>	<b>100%</b>

Source: own elaboration based on CENACE information

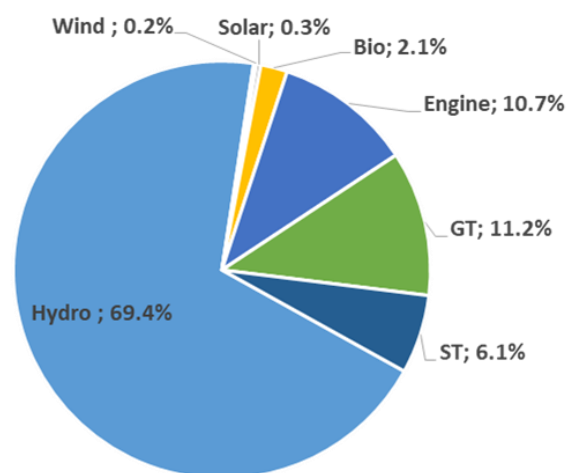
As of December 2020, the SIN represents 84% of the total installed capacity in Ecuador the remaining 16% is from isolated systems (Galapagos and other continental isolated systems). Most of the isolated power plants are thermal units (99% of the total) generally used for cogeneration or wellhead generation.

Generation availability may vary widely because depends on several factors such as hydrology, fuel availability, maintenance periods (scheduled or otherwise) useful life, etc.

In the interconnected system (SIN), hydro represents near 69.4% of total installed capacity, thermal units 28%, and the remaining 2.6% is from non-conventional renewable energy sources (Biomass, Biogas, Wind and Solar). The last shows the incipient development of this type of energy in Ecuador. The biomass is mainly produced from sugarcane processing plants.

Hydroelectricity generation had a downward trend in the last 15 years, which was offset by the commissioning of Coca Codo Sinclair and Sopladora in 2016. The generation from hydroelectric plants presents variations due to the influence of the "El Niño" and "La Niña" climate phenomenon.

**Figure 1: Installed Capacity participation as of December 2020 in the SIN, 7308 MW**



Source: own elaboration base on CENACE data

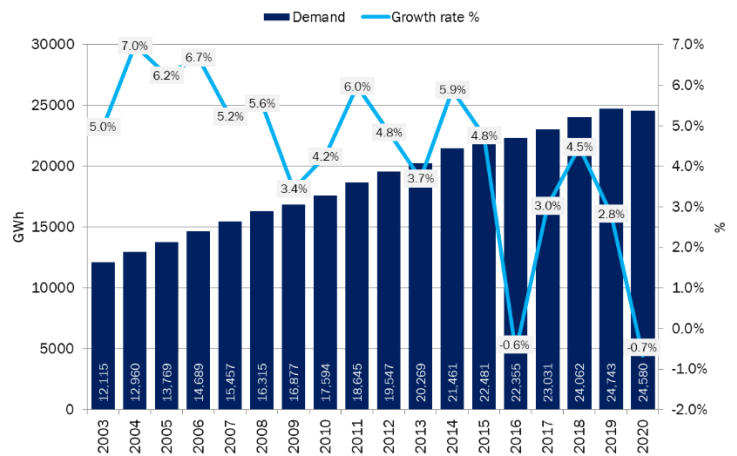
## Demand segment

The figure shows the historical annual demand and annual growth rate.

In 2020, national demand was 24,580 GWh with the peak demand for the same year being 3,950 MW.

The average growth rate in the last 15 years was 4.0%.

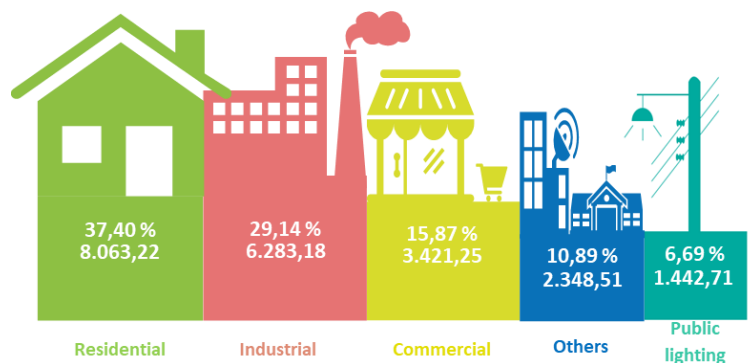
Figure 2: Annual demand (GWh) and growth rate (%)



Source: own elaboration base on CENACE (technical and non-technical losses are included)

Figure 3: Demand by Consumer by Type (2020) (in GWh per year)

The figure shows demand by type of consumer. The main type of consumer is the residential sub-sector, followed by Industrial and Commercial. Residential consumers contract their energy through distribution companies.



Source: Own elaboration based on ARCONEL statistics

## Transmission segment

The National Transmission System (SNT) is divided in six operative zones:

- North,
- Northeast,
- Northwest,
- South,
- Southwest and
- Southeast.

The SIN's high voltage SNT is composed of 500, 230 and 138 kV lines with a total of 6016 km (2020).

Table 2. Transmission Lines in the SIN (Km)

Voltage	Km
500 kV	610
230 kV	3,199
138 kV	2,207

Source: Transelectric (2020)



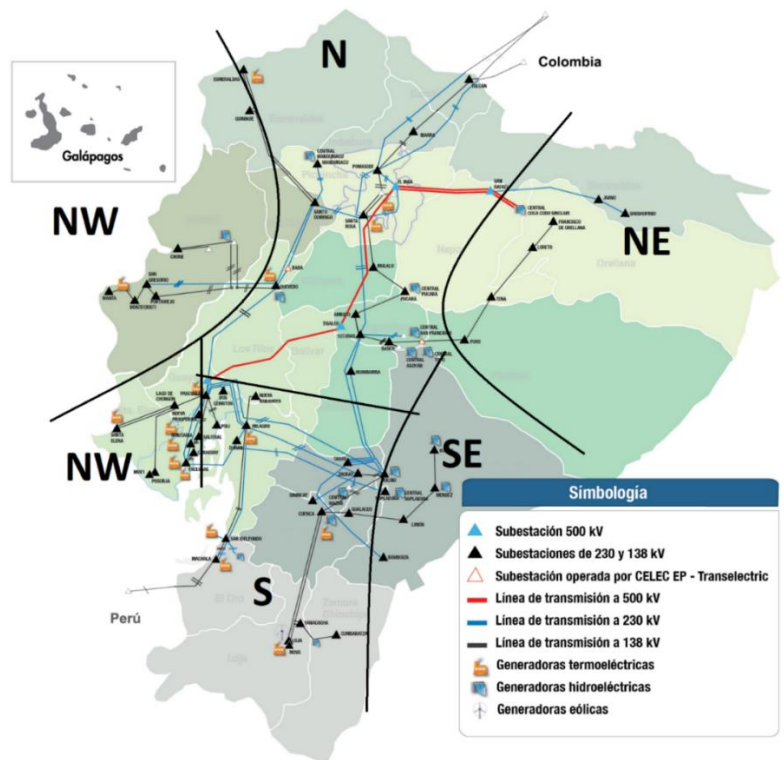
Ecuador has two international interconnections:

- With **Colombia**: two transmission lines: 230 kV, double-circuit Pomasqui - Jamondino line and 138 kV Panamericana-Tulcán line. The total transmission capacity is 540 MW nominal (525 MW effective),
- With **Peru**: 230 kV Zorritos-Machala line. and the total transmission capacity is 110 MW nominal (110 MW effective) (it operate radially with the Peruvian power system, non-synchronous).

Regarding the mechanisms for international transactions, Decision 536 of the Andean Community Commission establishes two: short-term market and intra-community electricity contracts. Since the beginning of the transactions with Colombia and up to date, there has been no agreement at the level of Regulatory Bodies on the mechanism of intra-community contracts, the reason for which only short-term transactions operate.

CENACE performs the economic dispatch of the Ecuatoorean market in coordination with the system operator in Colombia and Peru. Each operator defines electricity prices at the ends of international links. Using this information, CENACE performs an economic dispatch applying internal rules and calculates the supply price of electricity at the border node, according to Regulation CENACE 004/10. In the case of energy exchanges with Peru, they are based on contracts between CELEC EP and Peruvian agents.

Figure 4: Electric regions and national transmission system

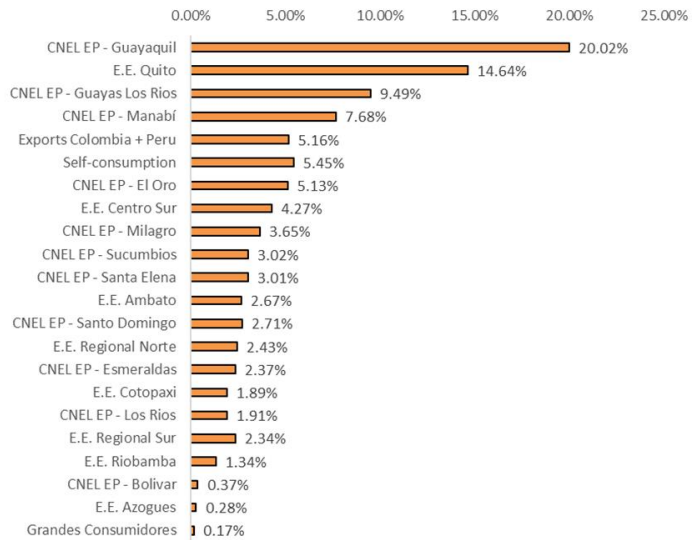


Source: TransElectric(2020)

## Distribution segment

Currently, there are 20 distribution companies. The following Figure shows the share of each Distribution company in the total demand, as well as the share of exports and self-consumption. CNEL-Guayaquil, E.E. Quito and CNEL-Guayas Los Rios represent the largest share of energy demand (44.15% in total).

Figure 5: Distribution companies share as a function of the total energy demand, 2020.

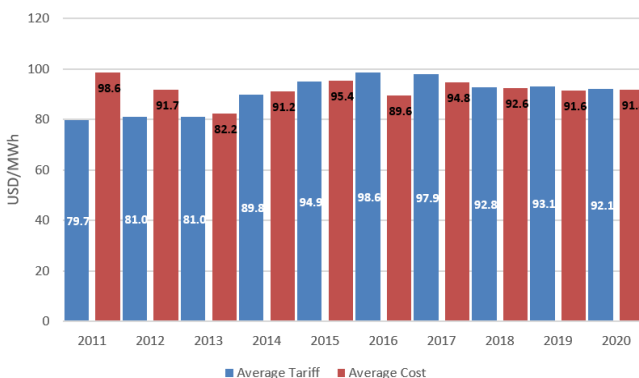


Source: CENACE annual report 2020

A plan for reducing electricity losses has been implemented successfully in Ecuador. Since 2007, losses in the Distribution grid have been reduced steadily over the years except for the last two years. Currently, technical losses in the Distribution grid reach 12.8%.

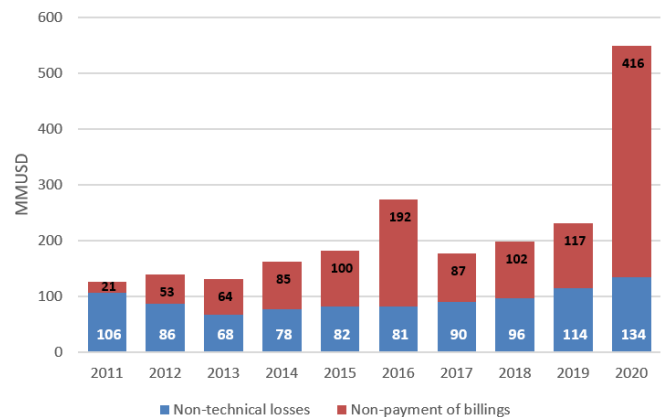
As shown in Figure 6, although tariffs are assigned to cover the cost of the system, there is still a difference between what is billed and what is collected, which is not enough to cover the costs, despite the efforts and technological changes that have been made, there are losses within the system, not necessarily technical, which increase the value of the subsidy to be covered by the deficit. Now, although this subsidy has been decreasing thanks to the incorporation of some hydroelectric plants and the reduction of some losses, Figure 7 shows that in the year 2020 the non-payment of invoices had an increase since it was an atypical year due to the COVID-19 pandemic, which caused a great economic impact that had repercussions on the increase of the deficit since the money collected was less than the money invoiced.

Figure 6: Historical evolution of the cost of service vs. tariff – 2017-2021



Source: own elaboration with ARCONEL data

Figure 7: Tariff Deficit Subsidy



Cost reflective tariff does not necessarily guarantee the coverage of the cost of service if this tariff is not collected. According to the last Electricity Atlas issued by ARCONEL in 2020, the total energy billed in Ecuador was MMUSD 1,851 (20,095 GWh) and only MMUSD 1,436 were collected, representing 78% of payment efficiency globally, not considering subsidies. Even this payment rate is rather high, there is still a remaining subsidy required to cover all costs. Therefore, subsidies to the power sector are expected to continue occurring, although the Government should be able to cover them.

## 5. LONG-TERM ENERGY TENDERS

The Ministry of Energy and Non-Renewable Natural Resources has initiated a series of calls for private investment in different projects; all of this supported by the local legal framework.

The Organic Law for the Promotion of Production, Attraction of Investments, Generation of Employment, and Fiscal Stability and Balance offers incentives for the development of new electricity generation projects with private investment. Among the main incentives are: exoneration of taxes on the withdraw of foreign currency (ISD tax<sup>3</sup>), exoneration of twelve years of Income Tax in the national territory and eight years if the investment is in Quito or Guayaquil.

Figure 8: Public selection process.



Source: own elaboration with Ministry of Energy and Non-Renewable Natural Resources data.

<sup>3</sup> Tax on Foreign Exchange Outflows

<sup>3</sup> Public Selection Process

## Tender 2021

The Ministry of Energy and Non-Renewable Natural Resources has updated the Electricity Master Plan, which includes the projects that will contribute to the coverage of the future energy demand, and which are part of the sector's policy to attract private investors.

As a result of this review, private investors were invited in 2021 to participate in a tender for the construction and operation of renewable projects (**NCRE blocks** - 500 MW) and a thermal generation project based on natural gas (**CCGN block** - 400 MW)

For the renewable tender block, the Ecuadorian government has several projects that are already in the pre-feasibility phase, and have some studies to meet the capacity requirement of each sub-block. More information on these projects can be found at the following link: <https://proyectos.recursosyenergia.gob.ec/bloqueErnc.php>

**Table 3. Tender 2021. Renewable sub-blocks**

	Required capacity (MW)	Concession term (Years)
<b>Sub-Block 1:</b> Hydroelectric	150	30
<b>Sub-Block 2:</b> Wind	200	25
<b>Sub-Block 3:</b> Photovoltaic	120	25
<b>Sub-Block 4:</b> Biomass, biogas, and biogas from municipal waste	30	20

Source: own elaboration with Corporación Eléctrica del Ecuador data.

For the CCGN block, the Ecuadorian government has include in the generation expansion plan, a natural gas combined cycle power plant, 400 MW installed capacity, that will use natural gas from local production. It will be built in the coastal region of continental Ecuador.

**Table 4. Combined cycle thermal plant characteristics**

Capacity MW	Connection voltage kV	Concession period	Payment
400 (+10%,-10%)	230	25 years	Fixed charge for available power. Variable charge for energy generated.

Source: Corporación Eléctrica del Ecuador.

The Ecuadorian government is calling for the acquisition of the bidding documents. After this, there will be two months to ask questions and six months to submit the offers.

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We were pioneers in global energy consulting, with the first market reforms in the 90s, and it is thanks to our expertise, our vocation for excellence, and our vision for the future that today we continue to be a strategic partner for all our clients.

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