

Embassy of India Caracas

MARKET SURVEY ON ELECTRICAL SYSTEM OF THE BOLIVARIAN REPUBLIC OF VENEZUELA

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Survey conducted by: AL&C Consulting Group, Caracas, Venezuela

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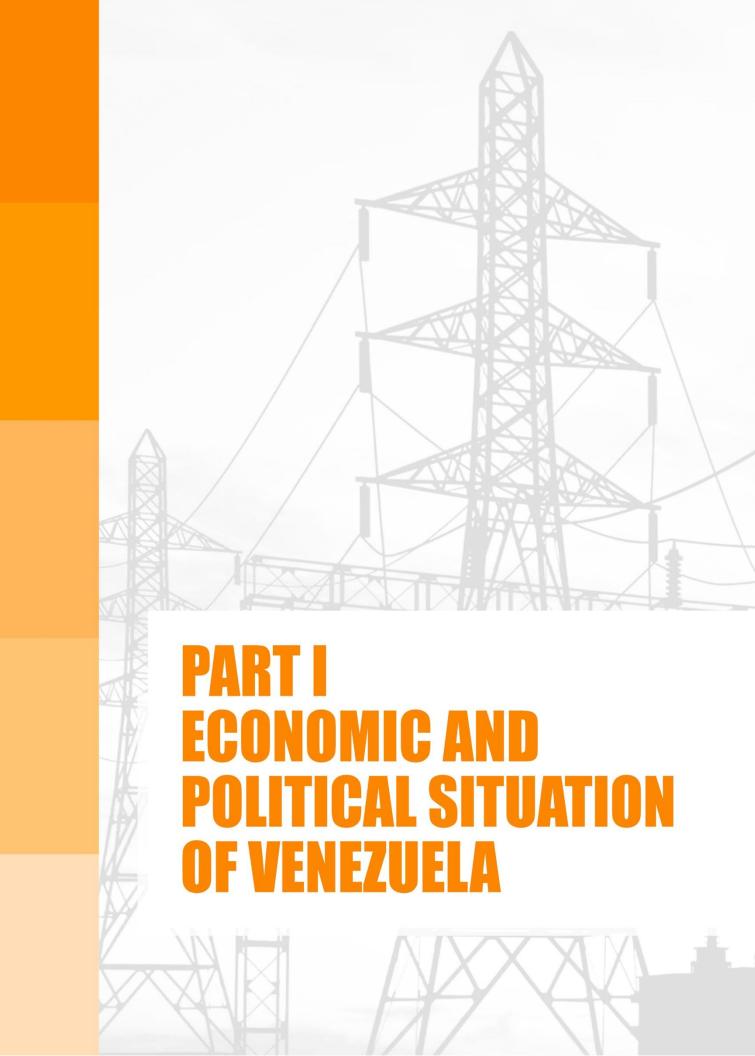
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Survey: Electrical System of the Bolivarian Republic of Venezuela

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ECONOMIC AND POLITICAL SITUATION OF VENEZUELA

According to the data submitted by the Venezuelan National Bank (Banco Central de Venezuela - BCV), the Venezuelan economy shows deep trouble with regard to economic growth: there were high rates (5%) in 2012, but since 2014 a sharp drop has occurred and the economy has been contracting for the seventh consecutive year.

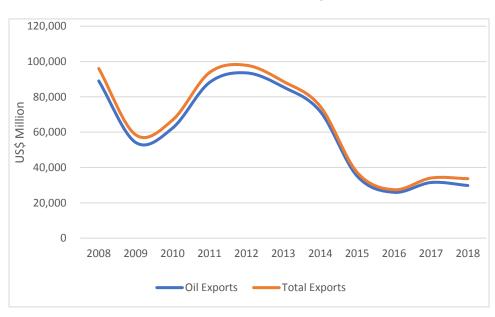
700,000 10.0 5.0 600,000 0.0 500,000 (5.0)JS\$ MILLION (10.0)400,000 (20.0)(15.0)300,000 (20.0)(25.0)200,000 (30.0)100,000 (35.0)(40.0)2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 GDP Constant Prices (100=1997)

2008-2020 GDP Constant Prices

Source: Central Bank of Venezuela

Despite being an oil economy, the contribution of the oil sector is becoming less important to the national productive apparatus, representing only 11% of the Gross Domestic

Product (GDP). This is a worrying situation because the oil sector is the only economic productive sector participating in international trade, and it should be noted that it contributes 98% of foreign currency income. Consequently, the rest of the non-oil productive sectors, representing a non-tradable (89%) sector of the economy, do not work under the criteria of efficiency and competitiveness. Furthermore, the collapse of oil prices in the market and the lack of investment have reduced foreign revenues for the Venezuelan economy. In addition, U.S. sanctions have discouraged foreign investment in the oil sector.



2008-2018 Oil Sector Exports

Source: Central Bank of Venezuela

The variation of prices is expected to remain at higher levels since the beginning of the period of hyperinflation, changing exponentially. Nevertheless, the speed of price changes has relented, and the inflation rate will be of 5,000% due to the partial dollarization of the economy that has encouraged economic activity and reduced scarcity levels.

In the period 2008-2018, international reserves have fallen to less than a quarter, reaching low levels similar to those experienced 40 years ago. This creates a strong pressure on external balances.

2008-2019 International Reserves (US\$ Million)

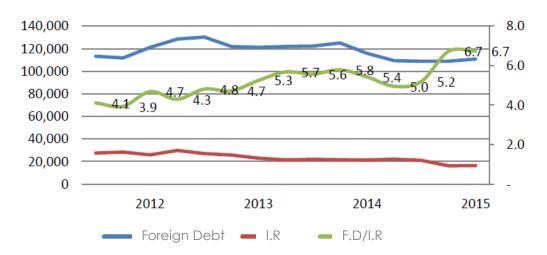
50,000
45,000
40,000
35,000
25,000
15,000
10,000
5,000
0
2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019

Venezuela
2008-2019 International Reserves (US\$ Million

Source: Central Bank of Venezuela

The growth of the foreign debt and the drop in international reserves make the current coverage less than 5%, meaning that the amount of international reserves only pays 5% of the total foreign debt. By 2017, the country had declared default over most of the debt bonds.

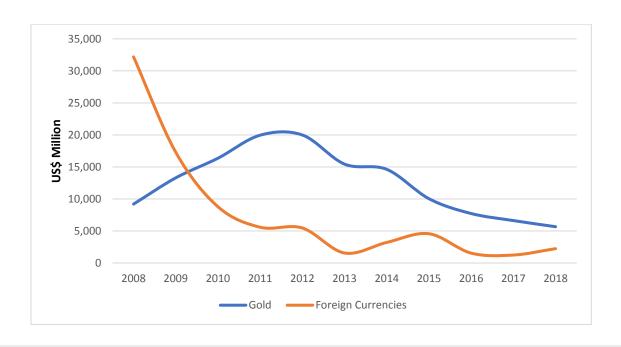
Relationship between Foreign Debt and International Reserves



Source: Central Bank of Venezuela

In respect of the position of the reserve assets, Venezuela decided to keep 70% of the reserves in monetary gold. From 2011 to 2019, Venezuelan international reserves have fallen from US\$ 21 billion to US\$ 7 billion, which is a drop of 66.6% in 8 years.

Reserve Assets (Gold and Foreign Currency)



Source: Central Bank of Venezuela

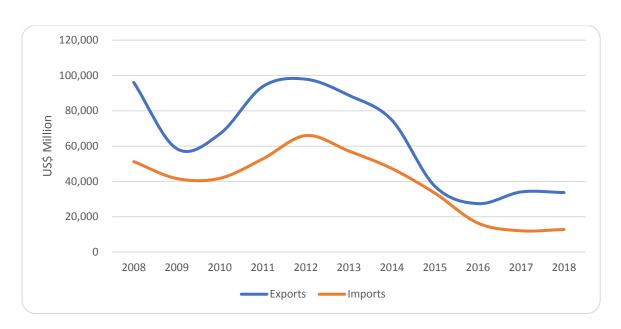
The balance of payments remained negative during the period 2008-2018, with the characteristic of maintaining surplus trade balances, but with capital outflows exceeding this surplus. By 2015, for the first time in 20 years, the third and the fourth quarters are shown with negative trade balances, mainly due to the fall in oil prices.

40,000 30,000 20,000 JS\$ Million 10,000 2011 2015 2010 2008 2009 2017 (10,000)(20,000)(30,000)Balance of Payments Current Account Financial Account

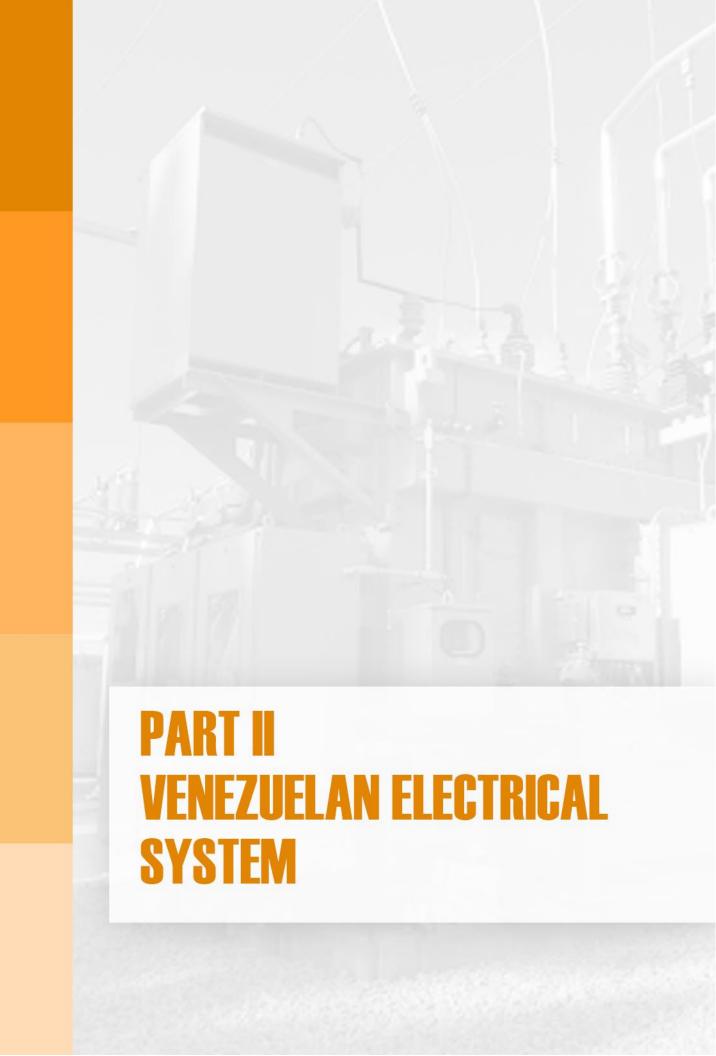
Balance of Payments (US\$ Million)

Source: Central Bank of Venezuela

Trade Balance (US\$ Million)



Source: Central Bank of Venezuela



VENEZUELAN ELECTRICAL SYSTEM

In Venezuela, the emergence and development of the first electrical power generation systems (hydroelectric power plants and thermoelectric units) meant an accelerated evolution and growth for the country at the end of the 20th century.

In 1947, Venezuela through the Corporación Venezolana de Fomento (CVF, Venezuelan Development Fund), started to plan its electrical service. In 1956, the first national electrification plan was elaborated in order to attend the three main regions of the country in the Central, Eastern and Western axes. In 1962, the first plan of the democratic age in the country (1958-1998) was planned with the Guri Dam as the basis of the system.

The development of the oil industry and the income generated for the National Executive Power, marked the evolution and administration of the national electrical system; keeping away private initiative from the maintenance process, promoting the participation of the executive in this sector as an entrepreneur in production, distribution, marketing, and expansion plans.

Hydroelectric sources in the country:

 Simón Bolívar Hydroelectric Power Station – Guri Reservoir (1978), installed capacity 10,325 MW

- Uribante y Caparo Dam (1987), installed capacity 1,260 MW
- Macagua I & II Dam (1996) total combined installed capacity 3,152 MW
- Caruachi Dam (1997-2006) installed capacity 2,160 MW

Thermoelectric sources in the country:

- Ricardo Zuloaga Thermal Power Plant (1941), installed capacity 27,000 KW (Not operational)
- Josefa Camejo Thermal Power Plant (2008), installed capacity 450MW
- Argimiro Gabaldón Thermal Power Plant

Between 1980 and 1990, the operation of the national electrical system was characterized by the interconnection contract and the existence of development plans for this sector. The Executive Power made the most of the world economic crisis to consolidate the Interconnected National System (or SIN), promoting a stable relationship between private and state companies under interconnection contracts.

As the sector expanded, more specific needs were required to be met, related to the complexity and magnitude of the system. The State was in charge of the total national generation capacity, as well as the total of the transmission lines, 100% of the 765 and 400KW ones were managed by the company *Electrificación del Caroní* C.A. (EDELCA).

A total of 99% of the 230KW and 98% of lower voltages was under the control of public companies. The distribution of electricity done by private companies stood at 13% of the total demand; state companies undertook 88% of the energy marketing (GWh) and

private companies 12%; public companies served 70% of the clients, the other 30% being served by private companies.

Until 2007, the main activities of the electrical sector were performed by private and state companies, and were divided as follows:

N°						OPERATION			
1	CADAFE					AREA NACIONAL			
2	CADAFE					LOS ANDES			
3	CALEY					SAN FELIPE			
4	CALIFE					PTO CABELLO			
5	EDEC					CARACAS			
6	EDELCA					GUAYANA			
7	ELEBOL					CITY BOLIVAR			
8	ELECENTRO					CENTRAL			
9	ELEGGUA					GUARENAS GUATIRE			
10	ELEOCCIDENTE					OCCIDENTE			
11	ELEORIENTE					ORIENTAL			
12	ELEVAL					VALENCIA			
13	ENELBAR					LARA			
14	ENELCO					COSTA ORIENTAL			
15	ENELVEN					ZULIA			
16	GENEVAPCA					CRP FALCON			
17	SEMDA					MONAGAS- DELTA AMACURO			
18	SENECA					NUEVA ESPARTA			
19	TURBOVEN					ARAGUA			
CA	CADAFE Associated Edelca Associated								

Source: International Transparency, Venezuela.

Companies used to perform those activities under a monopoly regime in each zone, and were regulated by the former Ministry of Energy and Mines, by applying rates by type of service.

After the enactment of the electricity service law in 1999, the Ministry of Energy and Mines (MEM) became the responsible entity to prepare and develop a plan for the electrical

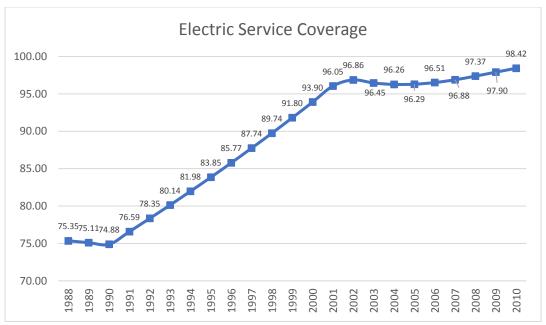
national electrical. However, it was not until 2004 when the First National Plan for the Development of the Electrical Service (*Plan de Desarrollo del Servicio Eléctrico Nacional-PDSEN*) was finally elaborated.

In 2007, the National Government started a process of nationalization of companies and ordered PDVSA to acquire shares held by AES Corporation. Thus, the country became the owner of *Electricidad de Caracas* and all its affiliated companies. The President Hugo Chávez was authorized by the National Assembly, and he dictated the decree number 5330 "with the rank and force of Organic Law" for the creation of the National Electrical Corporation (Corporación Eléctrica Nacional-CORPOELEC), merging all state and private companies.

CORPOELEC, is a governmental corporation, an entity attached to the Ministry of People's Power for Electric Power (Ministerio del Poder Popular para la Energía Eléctrica-MPPEE). Among its functions are: to direct the planning and to control state electricity companies nationwide.

The productive chain of the sector started to have a single bearer company for the service in the whole country, reinforced by the promulgation of the Organic Law of the Electrical System and Service (LOSSE 2010), and established a monopoly on all activities of the sector: generation, transformation, distribution, and commercialization.

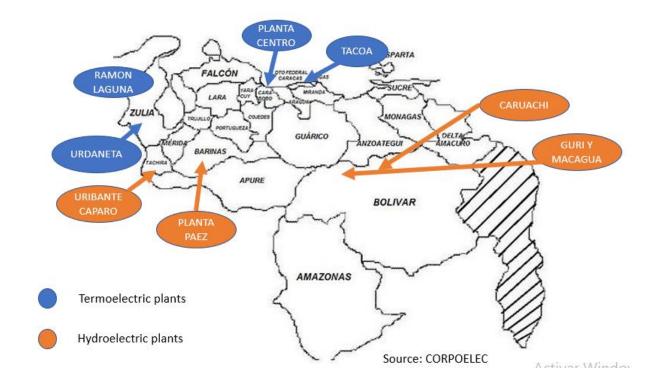
The coverage of the electrical service 1988 - 2010 is represented in this graph:



Source: World Bank, CORPOELEC

The coverage of the electrical service is displayed for the end of the 20th century. From the 90s, Venezuela experienced a huge growth, achieving 96% of coverage by the beginning of the 21st century, thanks to the works undertaken in generation, transmission and distribution, efficiently managed by companies of the sector.

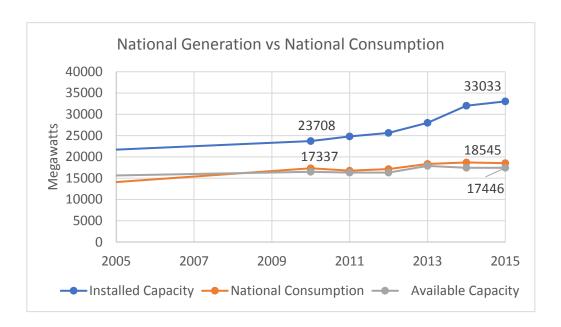
Generation



Source: CORPOELEC

According to CORPOELEC, the installed capacity of generation is 24,000 megawatts in optimal conditions. Nevertheless, since 2010 the electrical service has had deficiencies and the coverage does not fulfill national consumption. Due to the electrical system deficiencies, the Executive Power issued the first decree on electrical national emergency in 2010.

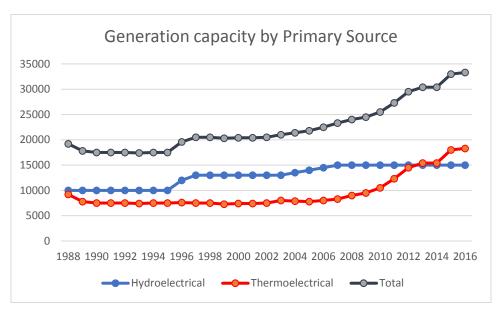
The following graph shows the installed capacity, maximum demand, and available generation.



	Installed Capacity	National	Available	Surplus/Deficit
	,	Consumption	Capacity	
2005	19696	10854	14787	3933
2010	23708	17337	16495	-842
2011	24801	16755	16321	-434
2012	25634	17157	16297	-860
2013	27996	18357	17881	-476
2014	32021	18696	17456	-1240
2015	33033	18545	17446	-1099

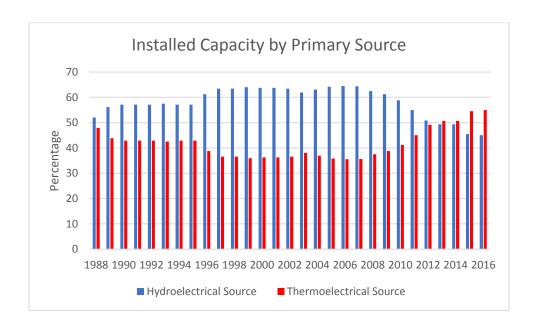
Source: National Assembly

In the next graphics, generation capacity can be seen by primary source:



Source: CORPOELEC

Hydroelectric and thermoelectric generation installed capacity:



Sources: Opsis, CGN, CORPOELEC, electrical companies

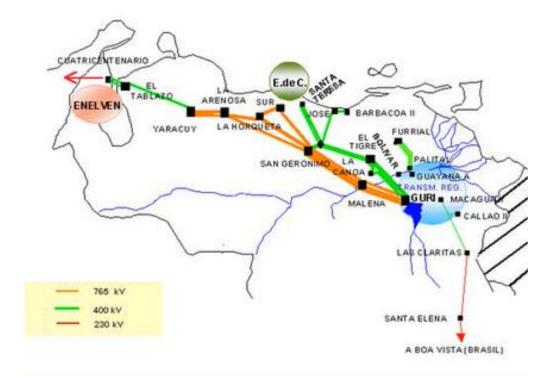
Previous graphics show how generation capacity is composed by two main sources: 65% hydroelectricity and 35% from fossil origin (gas, diesel, fuel oil). Since 2007, the generation system started to increase its installed capacity and to decrease its dependence on hydroelectric generation.

Even if production is at maximum levels there is a deficit to supply the service due to the following reasons:

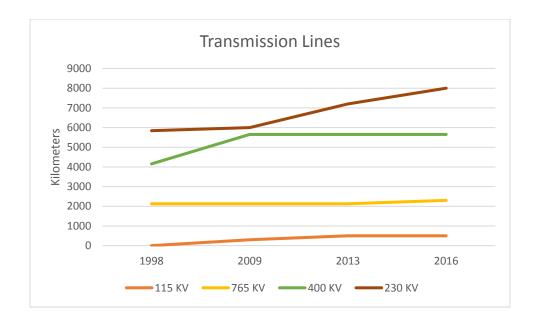
- Underestimation in the calculation of the maximum coincident demand.
- Unavailability of the thermal facilities for corrective maintenance.
- Unavailability of gas fuel.
- Unavailability of the transmission network

Transmission and Distribution

CORPOELEC has an extended electrical network across the country. Distribution is characterized by transmission lines from the main hydroelectric generation centers located in the Guyana region, and from there to the other regions of the country. The system is divided into six regions as shown in the following image.



In Venezuela, the development of the transmission system has not experienced significant growth in the last 20 years. Since 2013, 862 kilometers of new lines have been built:



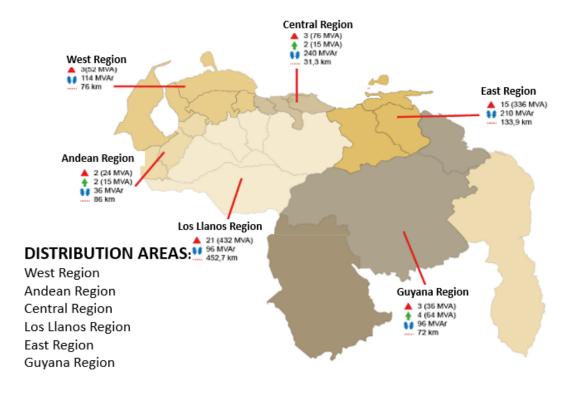
Sources: Opsis, CGN, CORPOELEC, electrical companies

- 2013 Curupao in Guarenas and Guatire, Miranda state.
- 2014 Chacopata submarine cable Margarita 230KW 40KW to guarantee connection to the Fabricio Ojeda system – 148 Km.
- 2015 LT El Tablazo-Mene Mauroa Dabajuro 115km.

Generally, energy delivery has two phases; 1) *Transmission*, in which large blocks go to consumption centers, traveling great distances (thousands of kilometers); and 2) *Distribution*, in which the transmission task is ended and the energy is delivered to population centers where that energy is distributed through networks of lower capacity.

The distribution of the national electrical system is made up of lines, transformers and electrical substations that operate at different voltage levels. It is divided into 6 zones:

- Central Region: New SSEE 3 (76MVA), new extensions 2 (15MVA), reactive compensation in SSEE 240 MVAr, new circuits 31.3 Km.
- Western Region: New SSEE 3 (52MVA) reactive compensation in SSEE 114
 MVar, new circuits 76 Km., new circuits 86 Km.
- Los Andes Region: New SSEE 2 (24MVA), new expansions (15MVA), reactive compensation 36 MVar, new circuits 86 Km.
- Los Llanos Region: New SSEE 21 (432 MVA), reactive compensation in SSEE
 96 MVA and new circuits 452.7 Km.
- Guayana Region: New SSEE 3 (36 MVA), reactive compensation in SSEE 96
 MVar and new circuits 72 Km.
- Eastern Region: New SSEE 15 (336 MVA), reactive compensation in SSEE 210
 MVar and new circuits 133.9 Km.



Source: CORPOELEC

Commercialization

The commercialization of the electricity sector contemplates the completion of the production process of energy, distributed through channels all over the country, meaning that the sector can self-finance its expenses or its capital expenses, through the invoicing of provided services.

From 1999 to 2015, CORPOELEC has expanded 55%, but the real income of the company through invoicing has fallen 83%: in 1999, billing in real terms was Bs. 962MM, but in 2015 billing stood at Bsf. 181MM. This is a consequence of the inalterability of the rates in these years as part of a policy to guarantee the service to the less favored sectors. In real terms, it is a drop of 86% due to the inflation process in the last 16 years.

The fall in rates in real terms has been a determining factor that obstructs rationalization plans regarding consumption, because high-consumption users are not affected in their budgets due to the low cost of the service.

Starting in 2007, energy losses increased to 28%. In 2009 the figure was 34.5%. In 2013, only 65% of the energy generated was billed, and of this 65%, only 70% of the amount was collected. Consequently, globally only 45% of the net energy produced was collected in the commercialization.

The financial cost of the service is a considerable expense for the nation. The subsidy is made through the injection of capital through allocations by the Ministry of People's Power for Electrical Energy.



SECTOR REGULATORY SYSTEM

The historical evolution of the legal framework of the Venezuelan electrical sector has gone through different renovations. Currently, the system is governed by the Organic Law of the Electrical Sector published in Official Gazette No. 39,573 on December 14th, 2010. In general terms, the above-mentioned law reserves all activities of the electrical service sector to the National Executive Power, concentrating and centralizing these activities in a single operator, CORPOELEC, and prohibiting the performance of any of these activities by private companies. In this way, the core activities of the electrical sector production chain are limited, by law, to be carried out by a single operator. Even so, since the crises that have been happening from 2010 to 2019 the government has opened the sector to the participation of private companies.

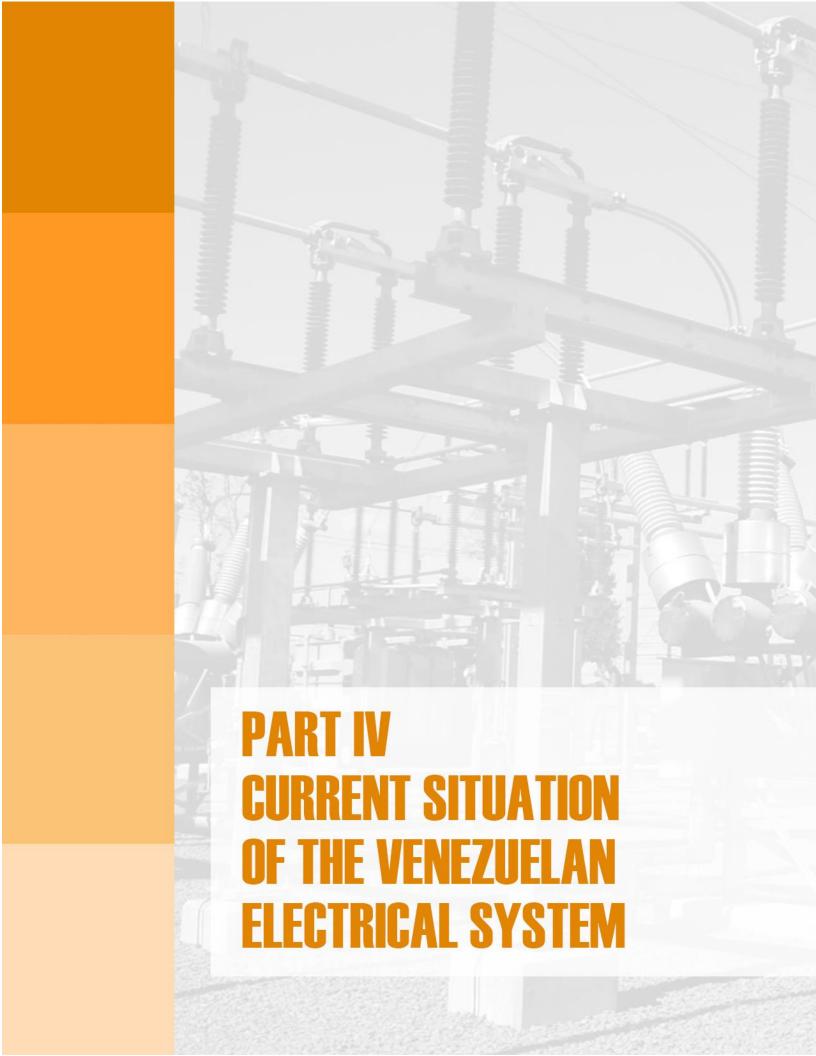
This opening to the participation of private companies is included in articles 3 and 4 of the aforementioned decree that establishes:

- Article 3: CORPOELEC is instructed to agree, upon a prior reasoned act, contracting by direct award.
- Article 4: The Ministry of People's Power for Electrical Power (MPPEE) is authorized to enter into agreements with independent even national or foreign suppliers for the purchase of electrical energy.

The Ministry of People's Power for Electrical Energy is in charge of carrying out development plans, and investment processes in accordance with the provisions of article 76 of the Law of Partial Reform of the Decree with Rank, Value and Strength of the Public Procurement Law, in accordance with the provisions of the Regulations of the Public Procurement Law. Consequently, in order to agree contracts with the electrical sector, direct communication channels must be used with the MPPEE, for the development of investment plans that strengthen the National Electric System through concession mechanisms to carry out core activities of the sector, hand in hand with CORPOELEC.

Currently at the legislative level, there is a draft Organic Law of the Electricity Sector that is in the discussion stage, and takes into account some aspects such as:

- Freedom of participation of national and international private investment
- Competitive market for energy sources
- Competition in access to network market
- Free access to networks
- Competition in generation and commercialization
- Respect to municipal competence in the provision of home services
- Independent control of service quality.

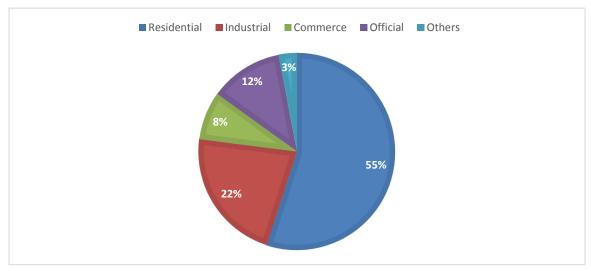


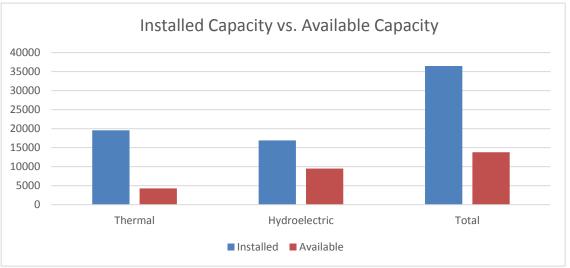
CURRENT SITUATION OF THE VENEZUELAN ELECTRICAL SYSTEM

Despite the investment made since 1999 until 2014 in all sectors of the National Electrical System, the additional available generation capacity was not sufficient compared to the investment. These investments were made to increase the capacity generation of thermoelectric and hydroelectric energy, but they did not translate into improvements in the supply of the entire generation and distribution chain.

Between 2008 and 2009, storage capacity decreased and total demand was no longer met, forcing the system administrator to carry out scheduled rationing since then, thus increasing the probability of failure.

Due to a decrease in the levels of electricity supply, on 08 February 2010 the first decree on a state of emergency was issued, related to the provision of electricity and the opportunity to foreign investment to participate in the sector (2010 - 2016). Despite these measures, the national electrical system failed in its attempt to increase its capacities and meet the country's demand.





Source: Habitat and engineering academy, 2020.

The total generation capacity is 34,000 MW, but the level of satisfaction of demand is 14,000 megawatts in the same period, allowing us to conclude that the system is operating at 38.2% of its capacity.

At the end of 2018, the industrial sector demanded only 22% of energy consumption, which translates into a decrease of 10 percentage points with respect to the demand by

the same sector in 2013. The installed capacity is 19,560 megawatts of thermoelectric energy, but the national system only produces or generates 4,290 megawatts, the remaining 78% is not produced.

The decline of satisfied national demand for electricity was 18,000 MW in 2013, down to less than 10,000 MW in 2019, attributable to the continued economic recession that the country has experienced during the period 2014- 2020.

In conclusion, the National Electrical System is comprised of a set of generation, transmission, distribution and commercialization operations throughout the country. It has a marked dependence on hydroelectric generation, and in recent years investments have been made to support a thermoelectric park with a generation capacity of 20,000 MW.

Despite the installed capacity, the supply of the system to the residential, industrial, commercial, official and rural sectors is still insufficient, mainly due to the lack of optimization of the different generation, transmission and distribution processes.

Maintenance in thermoelectric industries is necessary to improve the generation capacity of the National Electrical System. In the distribution system, there is a deficit in the maintenance of transmission lines throughout the country, as well as its components, such as single-phase and three-phase transformers and other components of the system's infrastructure.

The creation of a responsible commercialization and collection system will depend on the agreement on the service tariffs, which are always established by the central government.



FINAL CONSIDERATIONS

- 1. It is recommended for Indian companies to seek participation in improving thermoelectric production of Venezuela. The country requires a major engineering effort to install new gas or oil burning units at Planta Centro to restore the power generation capacity of the north central coastal belt, where the bulk of the production of non-oil goods is located.
- 2. Indian companies could seek participation along with Venezuelan private or public companies to develop alternative generation / commercialization projects. States such as Portuguesa, Barinas, Trujillo, Mérida and Táchira, essential for the agricultural production of Venezuela, have been affected by lack of constant electrical supply in the last 5 years. Such areas can be considered for developing solar or wind based energy projects, as their electricity demands do not require major thermoelectric plants.
- 3. In any case, a scope for participation could be feasible in managing the Uribante-Caparo and complementary thermoelectric projects that guarantee the quality of energy for the Venezuelan states. Indian companies may monitor possible tenders floated by the Venezuelan state-owned CORPOELEC that would allow for service contracts in any of the existing regional projects.

- 4. The participation of Indian companies could be as part of a Joint Venture project, or another associative scheme with Venezuelan companies. Joint Ventures would contemplate the restoration of the electrical interconnected project at national level. It is possible to consider making Indian companies as a key partner of Venezuela in the field of renewable energy due to the great Indian experience on the matter. In terms of renewable energy, Venezuela is still in early stages in comparison with India. Therefore, Indian companies could promote alternative energy projects in zones with geographical difficulties where large thermo-electrical projects are difficult to establish.
- 5. As a consequence of the 2019 blackouts, Venezuelan commercial establishments as well as residential areas, have started to install diesel / gasoline and natural gas electricity generators at their facilities. Since then, a new market for affordable generators has been created, as the affected sectors are now taking measures to manage during prolonged blackouts in the future. Indian companies may promote the export of residential and commercial power generation equipment.

POSSIBLE AREAS OF INTEREST FOR INVESTMENT

Venezuela relies heavily on non-renewable energy, but the future may change, especially because the country has not made large investments in energy sector.

In Venezuela, a socialized system could be created, allowing the introduction of solar panels for commercial operations, to reduce energy costs and global carbon emissions, all within the framework of a macro project with the Ministry of People's Power for Electrical Power and the Ministry of People's Power for Science and Technology of the Bolivarian Republic of Venezuela.

Given the importance and experience that India has in the use of hybrid solar-wind energy and a more efficient use of land with a lesser impact of energy generation, the following areas could be considered for investment in Venezuela:

- Devising a strategic support plan to guarantee safe and reliable generation of energy in the Andean region (states of Mérida and Trujillo) that are strictly touristic, agricultural and livestock areas.
- Regarding the thermoelectric generation and transmission of energy, an assistance program could be offered for the expansion plan of the electrical generation and transmission system nationwide. It is estimated that an installation of 13,089 MW of new generation capacity is necessary in Venezuela, which will require the supply of a large amount of technology for the electricity sector, for example:
- Exporting machinery and spare parts for TurboGas plants in single cycle of 475US\$ / kWe and Francis type turbines.

- Reactivating the electromechanical operations of the Manuel Piar Hydroelectric Power Plant (Tocoma).
- The incorporation of new technologies for the provision of electrical service.
- Expansion of the transportation capacity for the transmission backbone network.