



Sustainable Development Goals and Paris Agreement

Sustainable Development Goals (SDGs) are a global initiative adopted by global leaders during the United Nations Sustainable Development Summit held in September 2015.

This initiative comprises 17 interlinked goals that address a broad range of global social, economic and environmental challenges.

The plan includes the following goals: No poverty (1), Zero hunger (2), Good health and well-being (3), Quality Education (4), Gender Equality (5), Clean water and sanitation (6), Affordable and clean energy (7), Decent work and economic growth (8), Industry, innovation and infrastructure (9), Reduced inequality (10), sustainable cities and communities (11), Responsible consumption and

production (12), Climate action (13), Life below water (14), Life on land (15), Peace and justice strong institutions (16) and Partnerships to achieve the goals (17).

Goal 7, Affordable and clean energy, is aimed at ensuring access to affordable, reliable, sustainable and modern energy for all. And goal 13, Climate action, is aimed at taking urgent action to combat climate change and its impacts.

In line with the two goals mentioned above, the Paris Agreement was adopted in 2015. This treaty is aimed at holding

the increase in the global average temperature to well below 2 °C above pre-industrial levels, and it is consistent with sustainable development goal 13, Climate action. The agreement's signatory countries are committed to reducing their greenhouse gas emissions and to working together to limit the impacts of climate change. ➤

In order to comply with the commitments made under the Paris Agreement, signatory countries committed to increasing nationally determined contributions (NDCs), which are voluntary commitments of countries as part of the agreement to reduce their greenhouse gas emissions and adapt to the impacts of climate change. Each country presents its NDC setting forth emission reduction goals and climate change adaptation measures, according to their domestic situation and their capacities.

Commitments made by Colombia

The country signed the Paris Agreement on April 22, 2016 in the United Nations Headquarters in New York. The adherence to the agreement was an important step for the country's commitment in fighting climate change and in promoting a more sustainable and fairer future for all. As part of the agreement, Colombia committed to reducing its greenhouse gas emissions and adopting climate change adaptation measures.

Colombia's latest NDC¹ was presented in December 2020. By means of that NDC, the country committed to reducing its greenhouse gas emissions by 51 % for 2030, versus forecasted emission levels with no further actions (without international cooperation to do so). This new commitment is more ambitious than the previous one, which set a 20 % reduction. Thus, Colombia undertakes a responsibility to have a carbon neutral economy by 2050.

One of the goals set in the NDC involves increasing the participation of renewable energies in the national energy matrix to 14,5 % by 2030, as well as to improving the energy efficiency. Additionally, Colombia is determined to reach a participation of renewable energies of at least 70 % of its energy matrix by 2050.



Energy Balance

According to the latest energy balance published by the Mining and Energy Planning Unit in 2021², total energy consumption reaches 1.402,4 PJ. This consumption is divided into the different economy sectors, including residential, industrial, transportation, agricultural, construction and non-energy consumption sectors. The most relevant elements of such end consumption are diesel (22 %), gasoline (20 %) and the National Interconnected System's electric power (17 %).

Electricity Matrix and Effective Capacity by type of generation

Total installed capacity of Colombia's electricity matrix is 18.959,19 MW³. The hydroelectric source is the main source of energy power generation in Colombia, representing around 66,2 % of installed capacity. The main hydroelectric dams are in the departments of Antioquia, Santander, Cauca and Tolima.

Thermoelectric generation represents approximately 30.7 % of the installed capacity. The generation of energy from non-conventional renewable sources (e.g. solar and wind sources) is a comparatively small source of energy generation in Colombia, and yet, a growing source. Solar energy generation represents approximately 2 % of the installed capacity and wind generation around 0.1 %. Finally, the remaining 1 % corresponds to cogeneration.

In general, Colombia largely depends on hydroelectric and thermal generation for its electricity matrix.

1. NDC Colombia: <https://unfccc.int/sites/default/files/NDC/2022-06/NDC%20actualizada%20de%20Colombia.pdf>
2. Balance energético nacional: <https://www1.upme.gov.co/DemandayEficiencia/Paginas/BECOEnergetico.aspx>
3. Estudio para la Hoja de Ruta de la Transición Energética Colombia 2050: CREE / Enel - <https://www.enel.com.co/es/prensa/news/d202211-resultados-hoja-de-ruta.html>



Main Electric Power Operators

There are several companies and entities responsible for the generation, transmission, distribution and commercialization of electric power in the country. The main companies, as to capacity and infrastructure is concerned, are as follows:

Company	Project	Type of energy	Installed capacity
Empresas Publicas de Medellin (EPM)⁴	The firm has a total of 25 hydroelectric plants, 1 thermal power plant and 1 wind farm that allow it to occupy a prominent place in the electricity sector of Colombia with a participation of 21,11 % of the demand served in the country.	Hydroelectric, wind and thermal sources	4.083 MW
Enel Colombia⁵	Enel Colombia has twelve hydroelectric and two thermal power plants, located in different departments of the country. In November 2015, the El Quimbo Hydroelectric Power Plant came into operation, delivering energy to the Colombian electricity system, with an approximate power of 400MW and with the capacity to contribute 4 % of national demand. With this installed capacity, Enel Colombia has a net installed capacity equivalent to 21 % of the capacity at the national level, which ratifies it in second place among the generating agents in the country.	Hydroelectric and thermal sources	3.501 MW
Isagen⁶	The company has a total of 19 generation plants totaling nearly 3,000 megawatts, MW (2.914,7 hydro, 32 wind and 38 solar Net Effective Capacity).	Hydroelectric, wind and solar sources	3.000 MW
CELSIA⁷	The company has operations in Colombia, Panama, Costa Rica and Honduras. It has a total installed capacity of 2.009 MW, of which 81 % are installed in Colombia.	74 % of its installed capacity responds to renewable energy sources	1.634 MW
Gecelca⁸	Gecelca owns two thermal power plants, Termoguajira, located in the department of La Guajira and Gecelca 3, in the department of Cordoba.	Thermal sources	727 MW

4. Sitio web de la firma: <https://cu.epm.com.co/clientesyusuarios/energia>
5. Sitio web de la firma: <https://www.enel.com.co/es/conoce-enel/enel-generacion/innovacion-tecnologica.html>
6. Sitio web de la firma: <https://www.isagen.com.co/es/web/guest/home>
7. Informe de gestión de CELSIA: <https://www.celsia.com/wp-content/uploads/2023/03/Informe-de-Gestion-2023-completo.pdf>
8. Sitio web de la firma: <https://www.gecelca.com.co/>

Chinese investments in the Colombian energy market

- **Bosques de los Llanos Solar Park:** it is located in the municipality of Puerto Gaitán, in the department of Meta, Colombia. It has a total installed capacity of more than 125 MW and helps reduce emissions by more than 13,000 tons of CO₂ per year⁹. The Chinese company TRINA SOLAR¹⁰, the world's leading supplier of photovoltaic modules and smart energy solutions, was responsible for the investment, development and construction of the park.
- **Tepuy Photovoltaic Solar Park:** this photovoltaic park is located in La Dorada, department of Caldas, Colombia. It has an installed capacity of 83 MW and is connected through the voltage booster substation to the National Interconnected System (SIN)¹¹. In the development of the construction of the park, "Empresas Públicas de Medellín" (EPM) awarded the contract to the firm "Powerchina International Group Limited"¹².
- **Ituango Hydroelectric Power Plant:** the Ituango Hydroelectric Project is located on the Cauca River, in the so-called "Cauca Canyon", in the department of Antioquia, Colombia. The hydroelectric plant has a current installed capacity of 280 GWh-month¹³. The complete project

comprises a total generation of 13,300 GWh-year. This plant was built with capital from the co-financing fund of the Government of China administered by the IDB and coordinated by the People's Bank of China. In turn, the project received financing from the Industrial and Commercial Bank of China¹⁴.

- **Gecelca 3 and 3.2 thermoelectric plant:** the "Gecelca" thermoelectric plant is located in the Municipality of Puerto Libertador, Córdoba, Colombia. This plant has 2 different units. For its part, "Gecelca 3" has a capacity of 164 MW of net energy and has firm energy obligations assigned until 2032. On the other hand, the "Gecelca 3.2" thermoelectric plant has 273 MW of net effective capacity, with allocation of firm energy obligations until 2035. Together, these 2 units generate 437 MW of net energy. The investments were made by the CUC-DTC consortium formed by the Chinese state-owned enterprises: "China United Engineering Corporation Limited" (CUC) and "Dongfang Turbine Co." (DTC)¹⁵.

Projects in development

- **Baranoa Solar Energy Park:** this solar energy park is located in the municipality of Baranoa, in the department of Atlántico (north), Colombia. Annual power generation will reach 46 GWh,



providing clean electricity to 25,000 homes and creating a total of 300 local jobs¹⁶. The company "China Three Gorges Corporation", a clean energy group that focuses on the development and operation of large-scale renewable energy, made the investments of this project that brings with it an important contribution against climate change, as well as generation of employment and development for the community¹⁷.



9. Sitio web del Ministerio de Energía y Mina de Colombia: <https://www.minenergia.gov.co/es/sala-de-prensa/noticias-index/la-transicion%C3%B3n-energ%C3%A9tica-no-se-detiene-con-bosques-de-los-llanos-4-y-5-colombia-complet%C3%B3-25-granjas-solares/>
10. Sitio oficial de la empresa: <https://www.trinasolar.com/es/trina-office-region/china>
11. Sitio oficial de la empresa EPM: <https://cu.epm.com.co/inversionistas/epm-avanza-en-firme-con-la-construccion-de-su-parque-solar-fotovoltaico-tepuy>
12. Sitio web Diario El Colombiano: <https://www.elcolombiano.com/negocios/empresas/epm-construye-parque-solar-en-caldas-2023-AC20664253>
13. Sitio oficial del gobierno de Medellín: <https://www.medellin.gov.co/es/sala-de-prensa/noticias/hidroituango-en-un-9082-avanza-su-construccion/#~:text=Para%20que%20tengamos%20una%20idea,central%20han%20generado%201.245%20GWh>
14. Sitio web Ambiente y Sociedad: <https://www.ambienteysociedad.org.co/banca-china-financia-hidroituango/>
15. Sitio de la empresa China United Engineering Corporation: <https://www.aecc.com.co/ctce-2-2/>
16. Sitio web del Gobierno de Colombia: "Nuevo proyecto de energía solar en Baranoa potencia rol protagonista del Atlántico en la transición energética": Elsa Noguera (atlantico.gov.co)
17. Sitio web del Foro Chino: http://www.chinacelacforum.org/esp/zgtlmjlbjgx_2/202305/t20230509_11073870.htm



Evolution of energy demand in a carbon neutrality scenario by 2050

As mentioned above, as per the latest energy balance, the **total energy demand** reached 1.402,4 PJ. However, the total energy demand in Colombia is expected to grow increasing this value to 1.900 PJ by 2050¹⁸. This variation is due to the population growth, the increase in the economic and consumption activity level that, in the aggregate, exceed the effect in terms reduction in the energy demand generated by the higher efficiency level of technologies.

For the period from the latest energy balance to 2050, the **electric power demand** will grow by 4 times current values (approximately 300 %). That is, the electrification must be extremely considerable. In terms of its share of total consumption, it will increase from 17 % in 2021 to approximately 52 % in 2050.

This is due to changes in consumption patterns like the electrification of end uses in the residential, commercial and public service sectors as well as in the transportation sector because of the introduction of electromobility. Likewise, a growing environmental awareness as well as an increase in the demand for cleaner sources of energy is expected.

Evolution of energy matrix by 2050 in order to cover the energy power demand

Colombia's total installed capacity today reaches 18.959,19 MW. For 2050, this matrix must have a total installed capacity that will be able to cover the demand of 91.000 MW¹⁹.

In order to meet the carbon neutral goals, the electric power generation matrix must move to one basically dominated by renewable sources. That is, significant changes must be made in such matrix structure.

As to hydroelectric energy, its current installed capacity is 12.546,28 MW, and, it is expected to be approximately 32.000 MW by 2050. This means that current capacity needs to be more than duplicated to reach a level representing 35 % of the matrix total.

For the installed capacity of solar energy, the matrix currently comprises 379,58 MW and it shall increase to 25.000 MW. In practice, the generation of solar energy shall increase to approximately 66 times its current values in order to reach a representation level in the matrix of 27 %. As to the wind energy generation, there is an installed capacity of 18,42 MW that shall increase to 25.000 MW in order to represent 27 % of the electricity matrix by 2050.

In such a scenario, there is an obvious gap between current installed capacity and the required installed capacity to cover the demand in 2050. This means that Colombia shall promote investments in the sector that will guarantee the required development in the electricity matrix.

Current Legal Framework: incentives for electric power generation

In order to guarantee this composition of the matrix and cover that gap, it is required to work on certain measures that will promote the development of energy, and, especially, of non-conventional energies through laws and programmes created for those purposes. Accordingly, the Colombian Government has established different incentives to improve the generation of electric power in the country, which are supported by different regulations setting forth the policies and guidelines for the nation's energy sector. These incentives include:

- **Tax Incentives:** the Government established tax incentives for companies investing in renewable energy projects, like payment exemptions for taxes such as VAT, and income taxes super deductions and the duty rate of goods for generation of energy from renewable sources reliefs.

18. Estudio para la Hoja de Ruta de la Transición Energética Colombia 2050 – CREE / Enel - <https://www.enel.com.co/es/prensa/news/d202211-resultados-hoja-de-ruta.html>

19. Estudio para la Hoja de Ruta de la Transición Energética Colombia 2050 – CREE / Enel - <https://www.enel.com.co/es/prensa/news/d202211-resultados-hoja-de-ruta.html>

- **Subsidies and aids for renewable energy projects:** the Government also offers subsidies and aids for renewable energy projects in the country through public and private calls to finance projects in areas like solar, wind and hydraulic energy, and biomass. For instance, the Financial Support Fund for the Energy of Interconnected Rural Areas (*Fondo de Apoyo Financiero para la Energización de Zonas Rurales Interconectadas* - FAER) funds renewable energy projects in rural zones.
- **Acts 1715 of 2014 and 2099 of 2021 of:** this acts, which regulates the **Funding Law** and the **Non-conventional Renewable Energies Program (ERNC, for its acronym in Spanish)**, provides for tax incentives for renewable energy generation projects, including the exemption of payments of taxes on import of equipment and the deduction of the investment for income tax purposes. It also establishes special credit lines for renewable energy projects and guarantee programs to reduce risks relating to investments in renewable energy projects.
- **Fund for non-conventional energies and the efficient management of energy (*Fondo de Energías No Convencionales y Gestión Eficiente de la Energía* - FENOGE):** this fund was created to finance renewable energy and efficient energy management projects in Colombia; it offers long-term loans and risk capital to innovative and sustainable projects. It is based on the Act 1717 of 2014 that defines the regulatory framework for energy efficiency and establishes energy consumption reduction goals.

- **Purchase of energy:** the Colombian government has established a system for renewable energy purchases by energy-generating companies. This allows renewable energy producers to sell their energy for stable and competitive prices, which allows them in turn to attract investors.
- **Clean Energy Certificates (CEC):** these licenses, which are regulated by Act 1715 of 2014, are an economic incentive granted to renewable energy producers in Colombia. Certificates are negotiable and allow renewable energy producers to obtain additional revenue in selling CECs in the energy market.

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