
COLOMBIA CO
RENEWABLE ENERGY
El futuro es de todos
Gobierno de Colombia
30 YEARS
PROCOLOMBIA
EXPORTS TOURISM INVESTMENT COUNTRY BRAND

ENERGY SECTOR IN COLOMBIA: KEY FACTS

In 2021, energy generation, effective capacity and demand grew by 6.6%, 1,6% and 5.2% respectively.

Energy Generation (GWh)

Effective Capacity (MW)

Energy Demand (GWh)

	Energy Generation (GWh)	Effective Capacity (MW)	Energy Demand (GWh)
2021	73,934	17,761	74,117
2020	69,324	17,484	70,422
2019	70,114	17,462	71,925

Source: XM. Expert Advisors

PROCOLOMBIA
EXPORTACIONES TURISMO INVERSIÓN MARCA PAÍS

3rd

country in Latin America in the Energy Transition Index 2021.

WEF, 2021

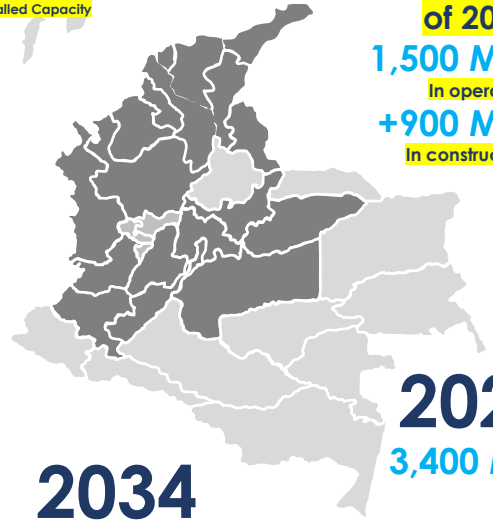
Increase in almost **50 times** the installed capacity of 2018 (28.2 MW) to achieve **1,500 MW** in 2022.

Renewables Sources Participation

In 2018

28.2 MW
Installed Capacity

By the end of 2022
1,500 MW
In operation
+900 MW
In construction



2023
3,400 MW

2034
21%

Source: Ministry of Mines and Energy

Carbon neutrality in Energy Sector

Reach net-zero by **2050**

Reduce CO2 Emissions (Mton*) by 2030* **11.2**

Climate Goals to reduce green house gas emissions by 2030 in: **51%**

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PROCOLOMBIA
EXPORTACIONES TURISMO INVERSIÓN MARCA PAÍS

BALANCE TO 2022

In operation

- **+20** Solar farms (1 in 2018)
- **2** Wind farms (1 in 2018)
- **1** BESS Project awarded in Public auction
- **Hydrogen** and **offshore wind** roadmaps

PROJECTED AT THE END OF 2022

In construction

- **8** Solar farms
- **14** Wind farms **504 MW** awarded in renewable auctions
- The biggest projects of the country
  Beta: 280 MW
  Alpha: 212 MW

Source: Ministry of Mines and Energy

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COLOMBIA has world-class renewable energy resources

Source: Ministry of Mines and Energy

WATER

More than 740,000 watersheds and a multiannual flow of 52 m3/s. The **installed capacity potential is 65 GW**.

WIND

More than 50 GW of potential installed capacity in the country. In La Guajira, we have a **wind speed of 9 m/s**, double than the world average.

SUN

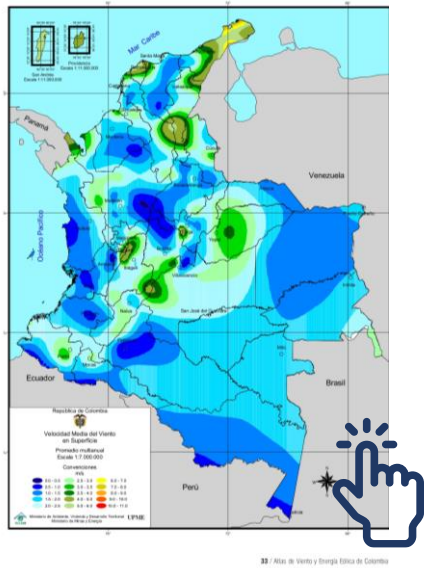
Colombia surpasses the world average solar radiation in 60%, **reaching 4.5 kWh/m2.**

BIOMASS

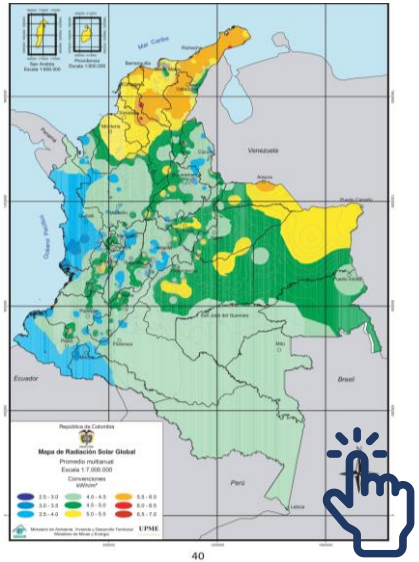
The country has a potential of more than 500,000 TJ of biomass per year, which corresponds to 46% of the national energy demand.

HIGH POTENTIAL TO DEVELOP RENEWABLE ENERGY PROJECTS

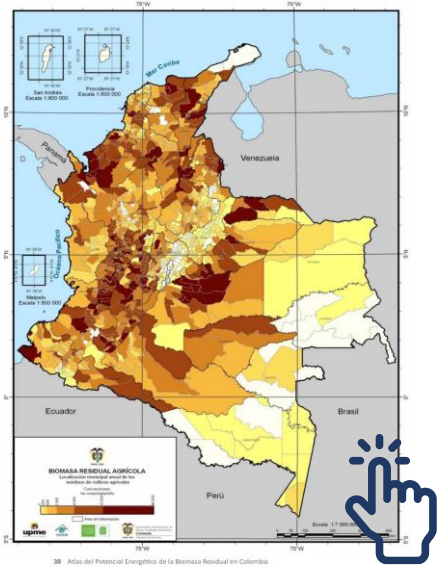
WIND POWER POTENTIAL



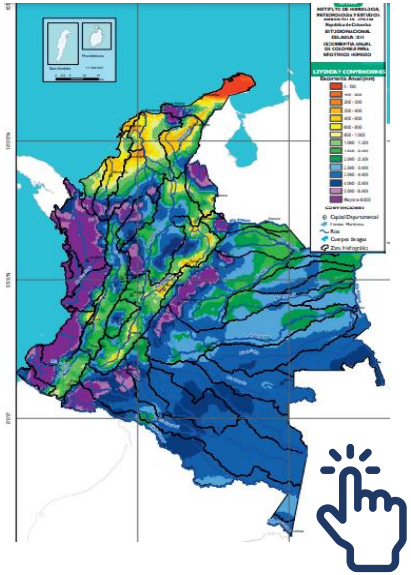
SOLAR POWER POTENTIAL



BIOMASS POWER POTENTIAL*



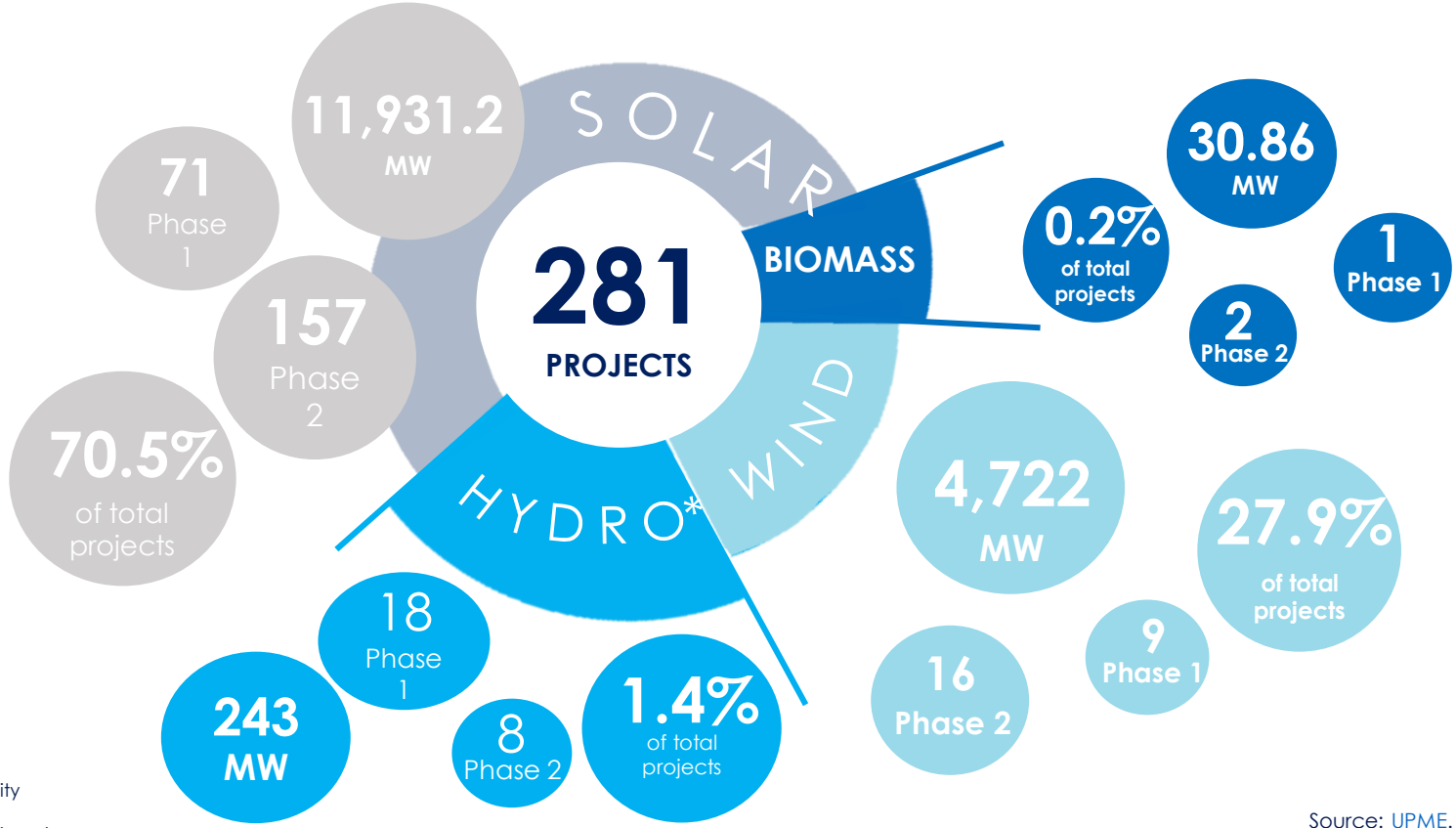
WATER POTENTIAL**



*The map shows the municipal location of agricultural waste. Colombia also has biomass potential in the livestock and urban organic solid waste sectors.
** National Water Study - IDEAM- Annual map of annual runoff for a typical wet year, year 2018.

Source: UPME National Mining and Energy Planning Unit

COLOMBIA HAS A DYNAMIC MARKET OF RENEWABLE ENERGY GENERATION PROJECTS



Phase 1: Prefeasibility
Phase 2: Feasibility
Phase 3: Detail Engineering

Source: UPME. Week 5, 2022
*SHP´s: Small Hydropower Plant < 20MW

NEW TECHNOLOGIES (HYDROGEN)

USD 5.5 BILLION OF INVESTMENT IN H2 PRODUCTION AND DEMAND PROJECTS BY 2030

POTENTIAL

1. Exceptional renewable resources.
2. Colombia has extensive natural gas and coal reserves.
3. Privileged geographical location to export.
4. A 30-years roadmap.

Goals 2030

Production

- 1-3 GW*
  Electrolysis capacity between 1.5-4 GW of NCRE
- 1.7 USD/kg LCOH* green
- 50 kt* H2 – 2.4 USD/kg
  Blue hydrogen production

Demand

- 1,500 – 2,000
  Light-duty fuel cell vehicles
- 1,000 – 1,500
  Heavy-duty fuel cell vehicles
- 50 – 100
  Public access hydrogen fueling stations

Source: Ministry of Mines and Energy
*NCRE: Non Conventional Renewable Energy *LCOH: The levelized cost of hydrogen. Kt: kilotons, a unit of energy*

30-YEARS ROADMAP

Scan to download

With the support of the Interamerican Development Bank – IDB and the UK Government the Colombia´s hydrogen roadmap, was launched on September 30th, 2021.

GREEN HYDROGEN PILOTS PROJECTS DEVELOPMENT

In 2022

Started operations:

2 First hydrogen pilot projects in the country

Ecopetrol installed a 50-kW proton exchange membrane (PEM) electrolyser and 270 solar panels at its refinery to turn industrial waters from the facility into high-purity green hydrogen.

Production: 20 kg/day in the next 3 months
Location: Cartagena

USD 140 Million each year in production of green, blue and white hydrogen.

Promigas, will use its electrolyser, a 137-kW solar farm and water from the Cartagena aqueduct network to produce green hydrogen to inject it into the natural gas grid for blending purposes.

Production: 1,574 kg/year
5th pase ~15 ton/year
Location: Cartagena

ecopetrol
ENERGÍA PARA EL FUTURO

PROMIGAS

NEW TECHNOLOGIES (OFFSHORE WIND)

PROCOLOMBIA
EXPORTACIONES TURISMO INVERSIÓN MARCA PAÍS

We are boosting the integration of new clean energy technologies

With the support of the **World Bank**, the **British Government and Renewables Consulting Group**, the **final report** of the **Offshore Wind Roadmap for Colombia** was launched on April 5th.

Scan to download

Potential: **50 GW** (**2.8** times the current capacity)

Areas: **13** in the Northern coast (Atlantico, Magdalena and La Guajira).

Fixed Technology: **6,800 km2**
Floating Technology: **5,400 km2**

Wind speeds: **Greater than 10 m/s** in some areas.

Water depths: **below 70 m** along most of the coastline.

Expected Investments by 2050: **USD 27 Billion.**

"Low" Scenario: Colombia could have 200 MW of offshore wind power by 2030; 500 MW by 2040; and **1.5 GW by 2050.**

"High" Scenario: Colombia could have 1 GW of offshore wind power by 2030, 3 GW by 2040 and **9 GW by 2050,** but a significant procurement program and coordinated transmission development is required.

Source: Ministry of Mines and Energy

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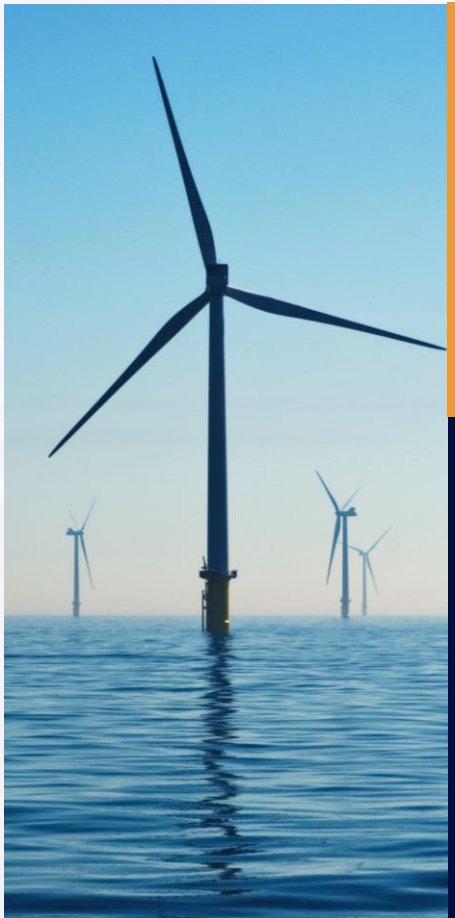
OFFSHORE WIND PROJECTS DEVELOPMENT

Enerxía and **BlueFloat Energy** are advancing in the development of **Vientos Alisios Project**. The project has: i) approved prefeasibility before DIMAR for the maritime concession; and ii) approved connection to the Bolívar 500kw substation.

Capacity: **200 MW**

Location: **Barranquilla**



Barranquilla, Colombia: **MOU with Copenhagen Infrastructure Partners**' (CIP) New Market Fund I K/S, to develop the megaproject.

Capacity: **350 MW**

Location: **Barranquilla**

Atlantic Energy Group is currently development in a prefeasibility phase three offshore wind projects that will be located at both sides and in the Magdalena River mouth and will aim at using the generated energy to produce green hydrogen and export it.

Added Capacity **1.1 GW**

Location **Barranquilla and Sitionuevo**

Source: Ministry of Mines and Energy, ProColombia

INSTITUTIONAL FRAMEWORK

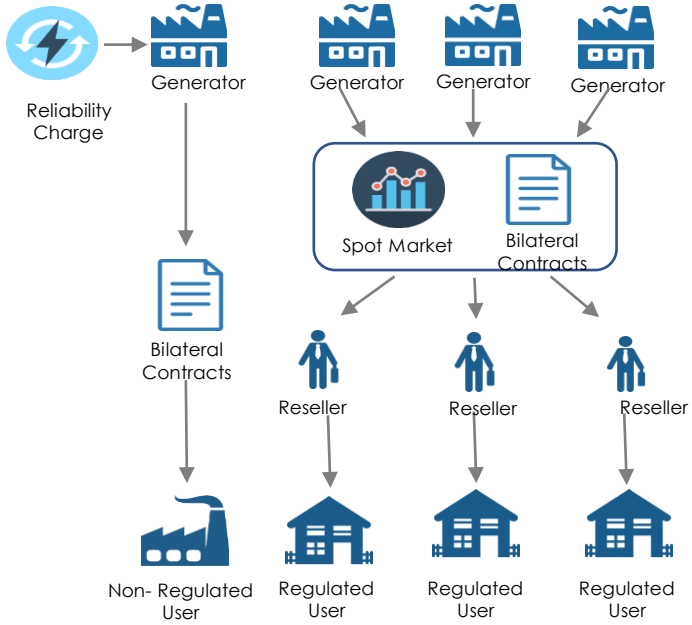
The country has a well-established institutional framework

- *Colombia has robust allocation and control mechanisms, where the government is a promoter and not an intervenor.*

- *These mechanisms ensure investment security, establish clear rules for all players and reduce uncertainty.*

Graphical source: ENEL

The energy supply is obtained through three mechanisms



Wholesale Energy Market (WEM) Transactions

Spot Market

- Generation companies declare availability of energy and bid prices at daily auctions
- XM dispatches supply orders to plants with an effective capacity >20 MW

Bilateral Contracts

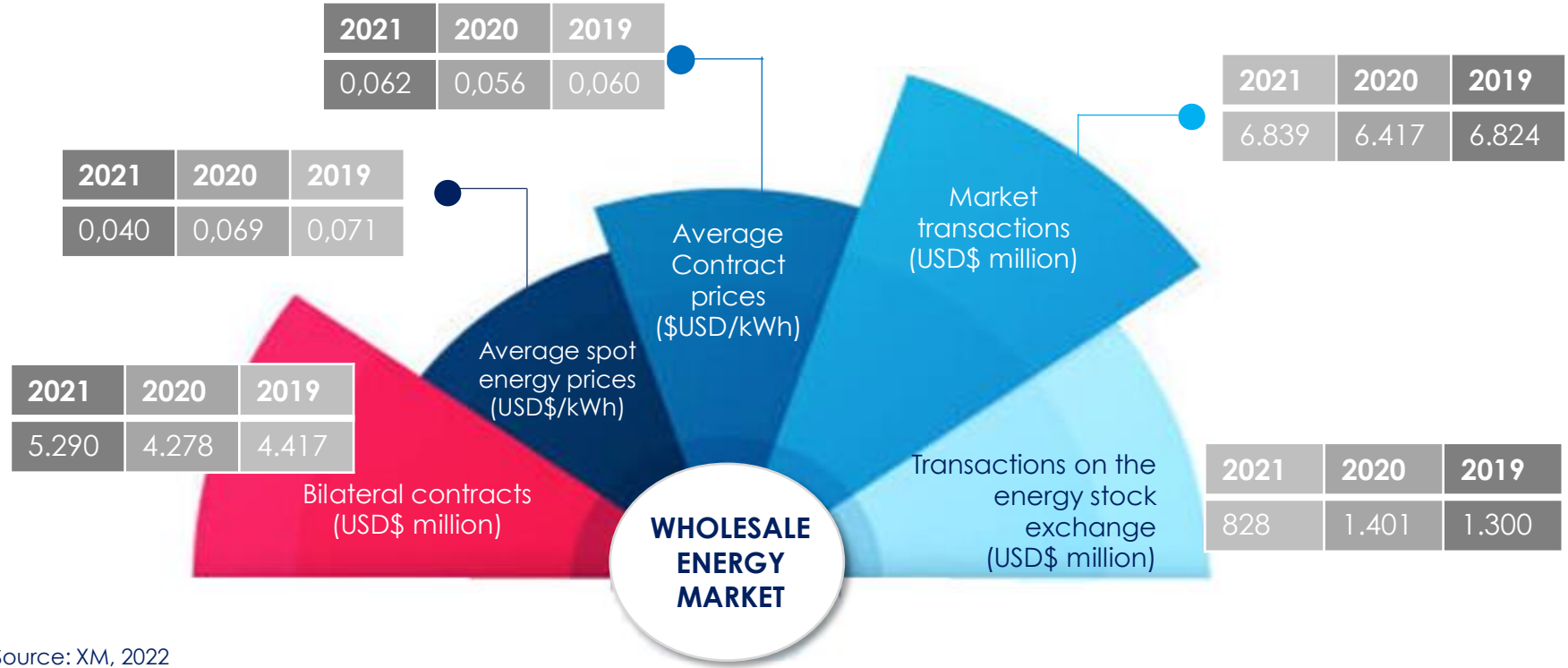
- Used in the financial market.
- Commitments acquired by generation companies and resellers to buy and sell electricity at prices, amounts and contractual conditions freely arranged between the parties

Reliability Charge (OEF)

- Mechanism for securing generation capacity
- Pays a stable amount to the generation company
- Commitment to generate power in times of scarcity

Fuente: EY

2021, YEAR OF HIGHEST TRANSACTION VOLUMES IN THE WHOLESALE ENERGY MARKET



Source: XM, 2022

*Average Exchange Rate 2021: 3.743,09 COP/USD. 2020: 3.693,36 COP/USD. 2019: 3.282,59 COP/USD

REGULATORY FRAMEWORK AND INCENTIVES

An attractive framework for energy investments

Incentives for generation with renewables / GEE

- **Deductiom from income tax 50% of investment, up to 15 years** from the year following the one in which investment came into operation.
- **VAT exclusion** on imports, national acquisition, of equipment, elements, machinery, and of national / imported services.
- **Exemption of import duties** for machinery, equipment, materials, supplies, without national production.
- **Accelerated depreciation up to 33.33% as global annual rate** for machinery, equipment, civil works for pre-investment, investment and operation, acquired and / or built.

Incentivos GEE /CCUS

- **Income Discount up to 25% of investment**, without prejudice to 50% special deduction. Only investments to reduce consumption / energy efficiency that correspond to environmental goals.
- **VAT Exclusion – GEE* and CCUS**** Only GEE investments that correspond to environmental goals for equipment, elements, national or imported for construction, installation, assembly, operation, control and monitoring systems, to comply with provisions, regulations, and environmental standards.

Alternative incentive / RPO***

- **Exempt Income from sales of energy generated with renewables for 15 years from 2017.**
- **Starting in 2023, wholesalers will guarantee that at least 10% of annual purchases to serve end users come from renewables**, through long-term contracts within the framework of market mechanisms, with supply periods equal to or greater than 10 years.

**GEE: Efficient Energy Management. **CCUS: Carbon Capture-Use-Storage. ***RPO: Renewable Purchase Obligation*

The country has designed a modern renewable energy auction program.

The objective is to maximize the benefit to consumers through efficient long-term pricing.

The auction is aimed at energy generation projects with non-conventional sources. The auction seeks to diversify the energy matrix, improve energy security and reduce dependence on oil price volatility.

The type of auction is two-sided, with voluntary participation of buyers and sellers.

The auction is open to any trading agent in the Wholesale Energy Market, regardless of whether it participates in the regulated market, the non-regulated market or both.

The result of the auction is a financial contract, of the " payment according to contract" type, with an hourly price equal to the sale price; with a duration of 15 years.

Colombia plans a new renewable energy auction in 2022

- It would be carried out in the first half of 2022.
- Wind projects that have investment plans and were left pending from the last auction. Off-shore wind projects could participate.
- Commercial operation would begin between 2024 and 2025.
- The Ministry evaluates applying the complementary mechanism at the same time as the voluntary mechanism

Source: Colombian Ministry of Energy, COP26

Non-Interconnected Areas

53% of the national territory, by municipality, are non-interconnected zones (ZNI).

Non-interconnected zones (ZNI) are municipalities, localities, townships and hamlets not connected to the National Interconnected System. They represent:*

1´141,748 km2
Total Colombian territory

18 Departments | **5** Capitals

224,294 Total users | **1,924** Localities

Operating capacity of **241 MW**,
of which **9.67** MW from Non-Conventional Renewable Energy Sources

Sources: IPSE, 2020

** Public electricity service providers located in the ZNI can develop, in an integrated manner, the activities of generation, distribution and commercialization.*

SUCCESS STORIES

SUCCESS STORIES - ENERGY

A diversified resource base and a strategic location in the Americas

ITALY

In Colombia, through Enel-Emgesa, it operates 14 hydroelectric, wind and solar plants, with an installed capacity of 3.3 GW.

CHINA

Trina solar energy supports the transformation of the Colombia energy matrix with the investment in a solar energy park (Llanos 1) supported by the FDN.

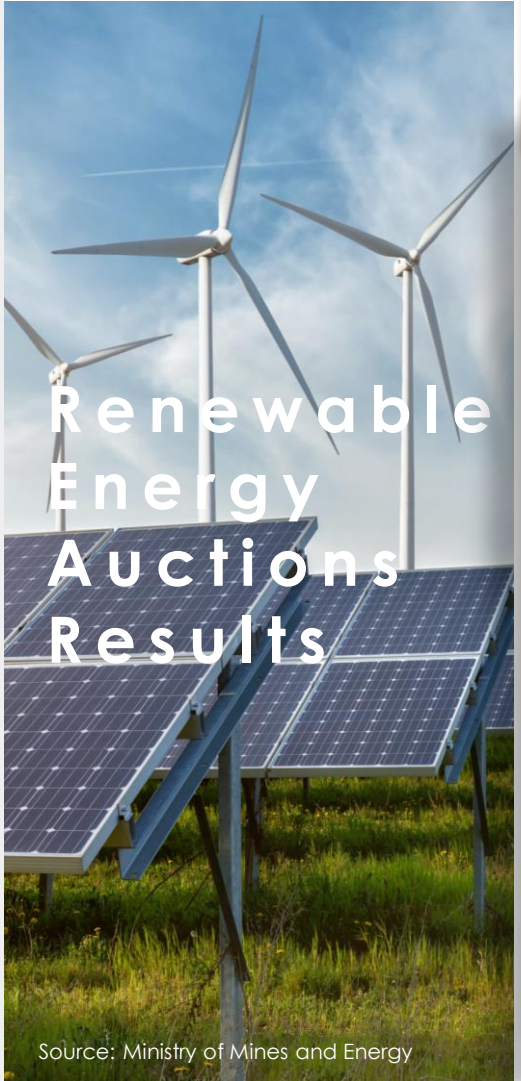
UNITED STATES

The American company AES, will allocate close to 1 Billion USD towards tripling the company's current installed capacity of 1.041 MW in renewable energy.

SPAIN

Enerfin is the wind power arm of Elecnor. In Colombia, it is developing around 500 MW of wind energy, which represents approximately USD 500 million.

Source: ProColombia- National Press Release



Renewable Energy Auctions Results

Source: Ministry of Mines and Energy

2019 AUCTION

1st *two-sided auction for renewable energies in the world*

Long-term bilateral contracts with 40% lower prices

14 solar and wind projects

1,300 MW

More than **6,000** jobs

USD $ 2.25 Billion of investment

2021 AUCTION

11 *solar generation projects*

Target demand : 5,520 MWh-day; Total awarded : 4,595.67 MWh-day

796.3 MW *of installed capacity*

9 *Power generation companies*

44 *Utilities (Power distribution)*

4,800 jobs

USD $875 Million of investment

LARGE SCALE
ENERGY STORAGE

Seeks to mitigate restrictions in Transmission networks

- **Awarded: July 2nd, 2021**
  (Canadian Solar Energy)
- **Location: Atlantico**
  (northern of Colombia)

1st Tender for storage system in Latin America

Capacity of 45 MW

Operation Date:
October, 2023

Investment:
USD 18,6 Million

Source: Ministry of Mines and Energy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