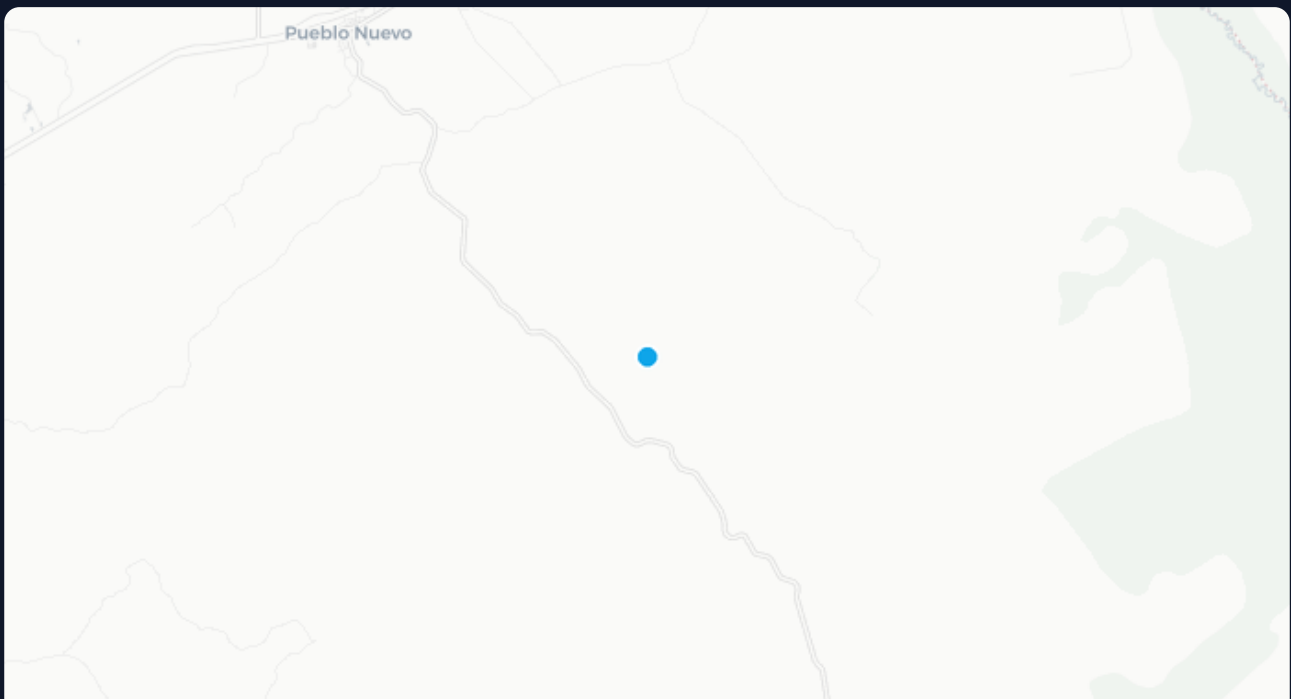


Solar pre-feasibility Colombia

Ariguaní · Magdalena Department · Colombia

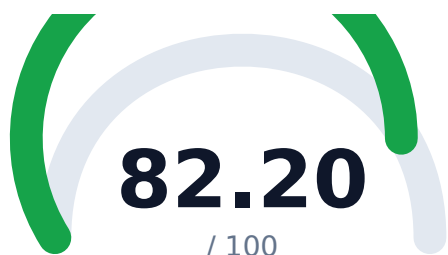
Point : 9.84517, -74.04594

Issued : 2026-07-17 · Reference : 7AE0B80E



Public-data red-flag pre-screening — this report informs a decision, it does not replace legal or technical due diligence (see methodology & limits at the end of this document).

Executive summary



FAVORABLE

Data coverage : 100 %

≥ 70 FAVORABLE · 45-69 CONDITIONAL · < 45 UNFAVORABLE

Solar resource — **100** (weight 30 %)

Grid connection — **54** (weight 25 %)

Terrain — **94** (weight 15 %)

Climate & natural hazards — **83** (weight 15 %)

Land & land use — **100** (weight 10 %)

Territorial context — **43** (weight 5 %)

Synthesis

The point sits in the municipality of Ariguaní, Magdalena Department, at 109 meters above sea level in the Colombian Caribbean lowlands. The immediate surroundings are rural and sparsely populated — roughly 513 inhabitants within a 5×5 km box, yielding a density of 21 people per km², consistent with an agricultural frontier landscape. The nearest urban center of meaningful size is Bosconia (Cesar Department, ~40,500 inhabitants), approximately 22 km away. Land cover is dominated by grassland (75.5%) with a significant tree-cover component (23.9%), suggesting active or former cattle ranching. The site sits within Colombia's frontera agrícola nacional under an unconditional classification, confirming state recognition of agricultural use. Soil data was unavailable due to a system timeout and should be obtained separately before any agronomic or construction commitment.

The natural risk profile is moderate and manageable. Seismicity registers 41 M4+ events within 300 km over five years, with the strongest reaching M5.5 — background-level activity for northern Colombia, not an acute deterrent but worth factoring into structural design. No active fires, no ongoing NASA-tracked natural events, and zero deforestation alerts over the past 12 months. The JRC surface water record shows no historical flooding at the point. Climate data reveals a pronounced rainfall seasonality: the prior 12-month period accumulated 1,841 mm, while the most recent 12 months dropped to 1,153 mm, a 37% year-on-year decline that warrants monitoring for agricultural planning. Peak temperatures can reach 38.7°C, and the mean sits near 29°C year-round — heat stress is a real operating consideration for both workers and equipment.

The solar resource is the standout signal for this location. GHI reaches approximately 1,989–2,074 kWh/m²/yr depending on the source, with a clear-sky index of 0.83 and very stable seasonality. Specific PV yield is estimated at 1,655 kWh/kWp/yr. The terrain is nearly flat (mean slope 0.4°), ideal for ground-mounted arrays. The nearest STN substation is Copey 220 kV at 36.7 km, with a 500 kV node at 36.9 km. Critically, 969 MW of solar projects have already been assigned UPME connection capacity within 50 km — including a 200 MW project explicitly named "Ariguaní" — signaling saturation risk at nearby connection points.

Three concrete points of attention for any investor or buyer. First, the homicide rate in Ariguaní has risen sharply — 5 in 2024, 11 in 2025, and 10 already recorded in the partial year 2026 — making security due diligence and community-relations assessment non-negotiable before any site development. Second, grid connection must be treated as a critical-path item: available capacity at El Copey and La Loma nodes may already be committed to approved projects; commission an UPME connection study immediately.

Third, the year-on-year rainfall drop of 37% should be cross-checked against NDVI and hydrological records before finalizing any crop or land-use model dependent on water availability.

Photovoltaic yield (Global Solar Atlas)

Specific yield

1,655

kWh/kWp/yr (PVOUT)

Global irradiation

2,073.80

kWh/m²/yr (GHI)

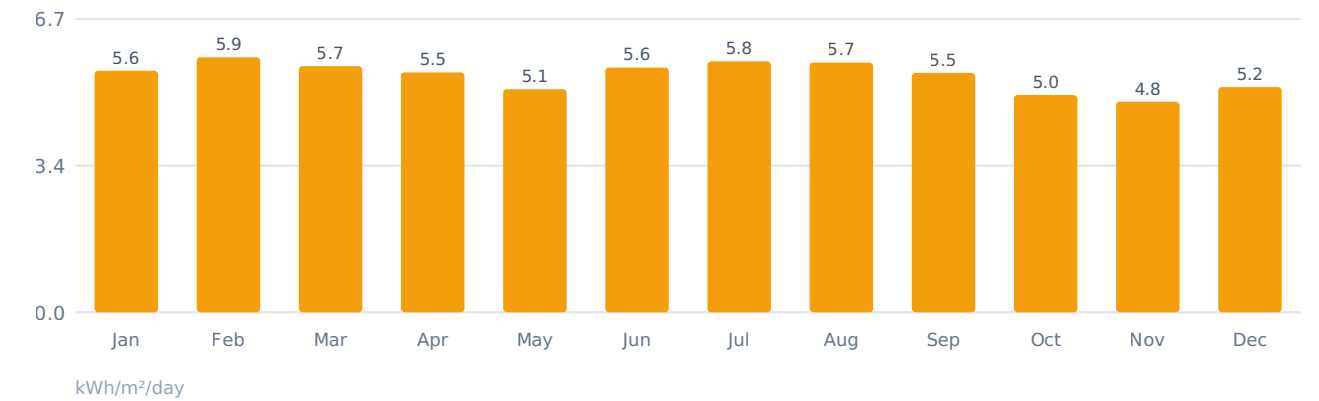
Optimal tilt

13°

GTI 2,117 kWh/m²/yr

Month-by-month solar resource (NASA POWER)

Mean global horizontal irradiation (long-term climatology, kWh/m²/day) · annual GHI: **1,989 kWh/m²/yr** · seasonal stability (min/max month): **0.83**



Terrain. Mean slope 0.80 % (aspect NO) · elevation ~108 m · roughness 3.40 m — 90 m DEM estimate (Copernicus), to be confirmed by a topographic survey.

Grid connection (UPME)

Nearest substation: **Copey 220 kV** at **36.70 km** (220 kV) · 4 substation(s) within 50 km · max voltage: 500 kV · nearest transmission line: 8.10 km

Substation	Voltage	Distance	Municipio
Copey 220 kV	220 kV	36.70 km	EL COPEY
Copey 500 kV	500 kV	36.90 km	EL COPEY
Copey 110 kV	110 kV	36.90 km	EL COPEY
El Paso 110 kV	110 kV	37.80 km	EL PASO

Capacity already assigned by UPME within 50 km: 13 project(s) · 969.20 MW (of which 969.20 MW solar) — actual connection capacity depends on the UPME/operator connection study.

Estimated photovoltaic production (PVGIS)

Simulated system: **10 kWc** (≈ 50 m²) · off-grid (batteries) · tilt **15°** · azimuth **0°**

Annual production

2,922

kWh/yr

Specific yield

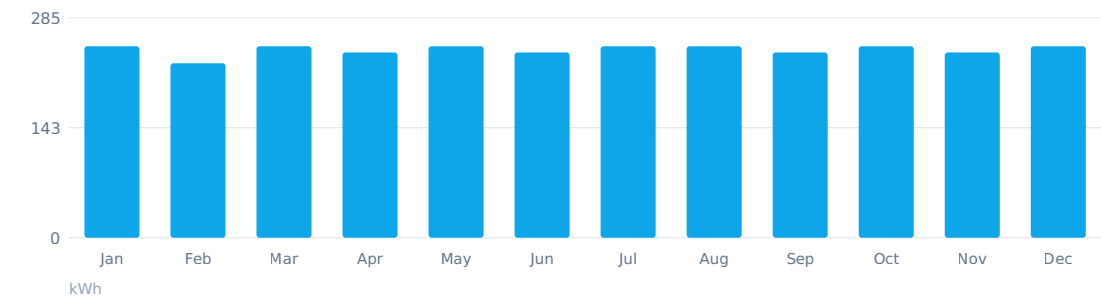
292

kWh/kWc/yr

Off-grid simulation : days battery full **99.97 %** · days battery empty **0 %** · energy not captured 10,817 kWh/yr

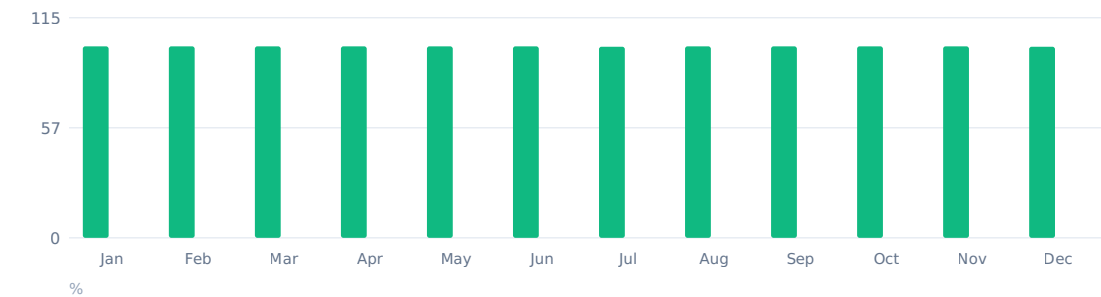
Simulation outputs (PVGIS)	
tilt	15°
azimuth	0°
Radiation database	PVGIS-ERA5

Estimated monthly production (kWh)



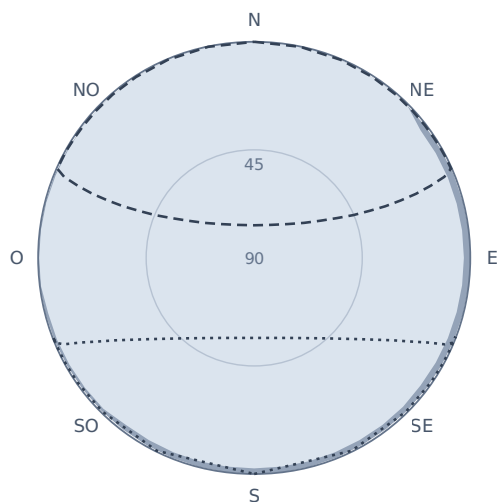
Monthly output of the simulated system (kWh) — PVGIS climatological average.

Battery state by month (off-grid simulation)



■ days battery full · ■ days battery empty — Share of days in the month where the battery ends full (surplus) or empty (unmet demand).

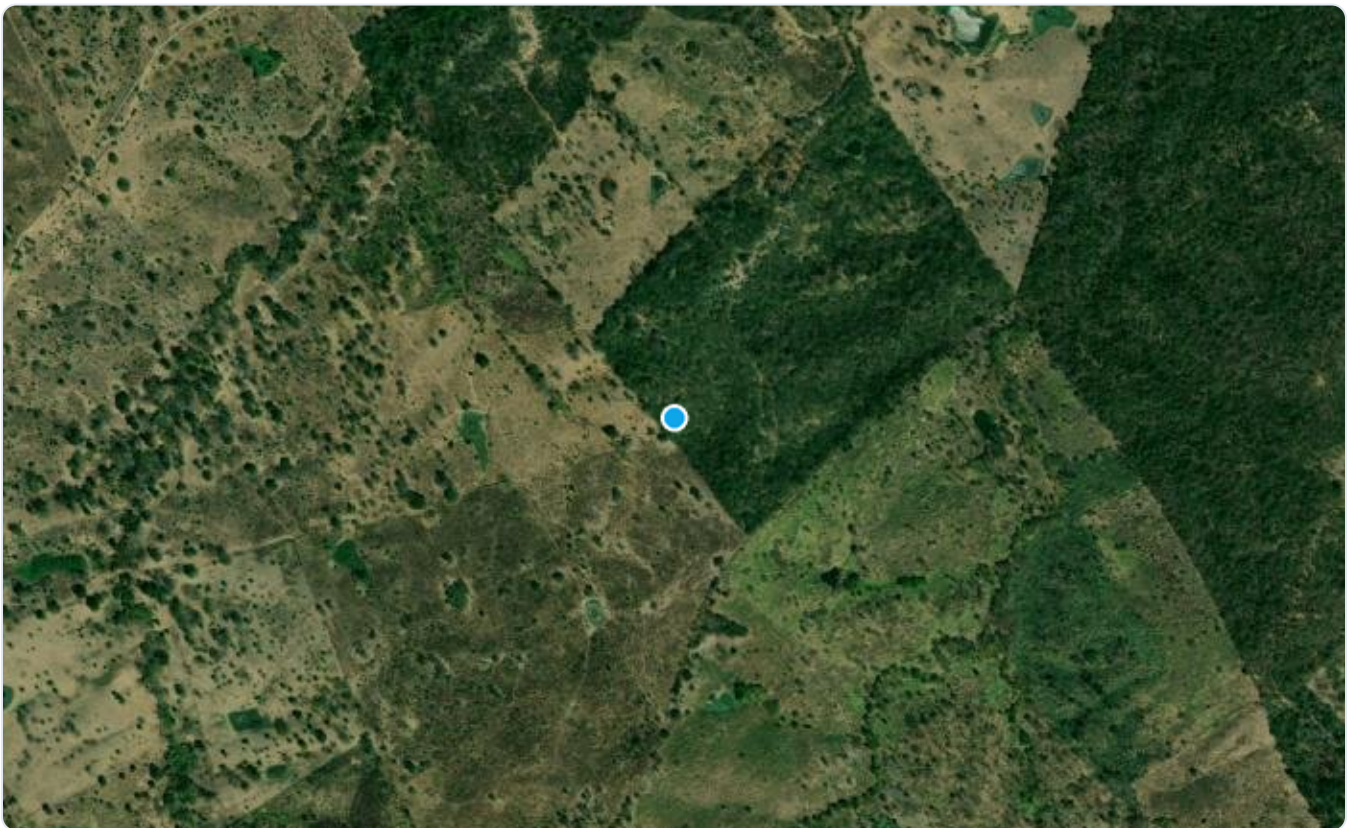
Sun path and terrain horizon mask (solstices)



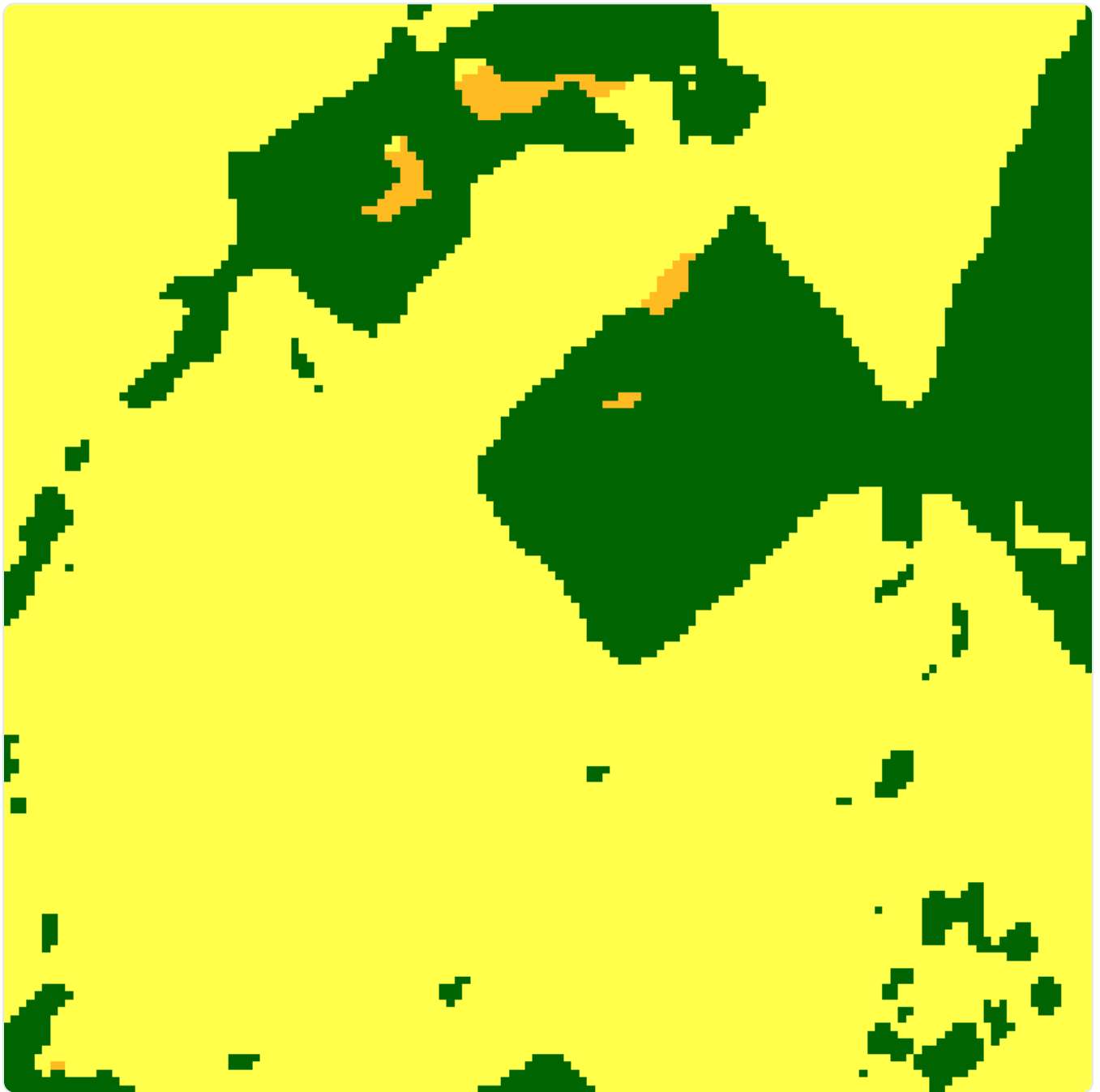
Grey = terrain blocking the sun (real computed horizon) · orange dashes = summer solstice · blue dots = winter solstice. Axes: azimuth (S centred) × sun elevation.

PVGIS simulation © European Union (JRC), ERA5 database — indicative, not a substitute for an engineering study.

Area imagery



Satellite view of the study area (polygon outlined) — imagery © Esri, Maxar, Earthstar Geographics.



■ grassland 75 % ■ tree cover 24.30 % ■ shrubland 0.70 %

Land cover — ESA WorldCover 10 m (2021), dominant cover at satellite scale (does not detect scattered or recent built-up).

Scoring detail

Each indicator is traceable: public source → observed value → points assigned. Dimensions without available data are excluded from the total and weights are renormalized (coverage shown on the executive page).

Solar resource — 100/100 (weight 30 % · effective 30 %)

GHI and simulated yield (Global Solar Atlas — Solargis/ESMAP/World Bank), NASA POWER seasonality. Bands calibrated to standard utility-scale bankability thresholds; a GHI < 1,400 kWh/m²/year remains viable for self-consumption.

Indicator	Value	Points	Reading
Annual global horizontal irradiation (GSA)	2,073.80 kWh/m ² /yr	100	excellent resource — on par with the best utility-scale sites
Simulated specific yield (PVOUT)	1,655 kWh/kWp/yr	100	excellent specific yield
Clear-sky index (actual GHI / clear-sky GHI)	0.83 ratio	100	low cloud attenuation — mostly clear skies
Seasonal stability (min month / max month GHI)	0.83 ratio	100	very stable resource year-round — steady production

Grid connection — 54/100 (weight 25 % · effective 25 %)

Built substations and transmission lines (UPME). Distances are indicative: actual interconnection capacity depends on the UPME/grid operator connection study — never a blocker, a cost signal.

Indicator	Value	Points	Reading
Distance to the nearest substation	36.70 km	30	costly transmission interconnection
Distance to the nearest transmission line	8.10 km	75	accessible line
Maximum voltage available within 50 km	500 kV	100	STN grid (≥ 220 kV) — suitable for utility-scale projects

Terrain — 94/100 (weight 15 % · effective 15 %)

Slope and evenness estimated from the Copernicus 90 m DEM (plane fit on a 5×5 grid) — pre-feasibility only, does not replace a topographic survey.

Indicator	Value	Points	Reading
Mean slope	0.80 %	100	nearly flat terrain — ideal for ground-mounted structures
Terrain evenness (residual roughness)	3.40 m	80	slight irregularities

Climate & natural hazards — 83/100 (weight 15 % · effective 15 %)

Temperature reduces PV efficiency (~-0.4%/°C above 25°C cell temperature); fires, seismicity and ongoing events provide context on operational risk.

Indicator	Value	Points	Reading
Mean annual temperature (NASA POWER)	29.52 °C	60	very hot climate — thermal losses to be factored into the yield
Active fires (5 days, extended area)	0 detections	100	no active fire detected
M4+ earthquakes (5 years, 300 km radius)	41 events	80	moderate seismicity
Ongoing natural events (EONET)	0 events	100	no ongoing event

Land & land use — 100/100 (weight 10 % · effective 10 %)

Protected areas (WDPA — a PV project inside or near a protected area implies stricter environmental licensing, ANLA/CAR). The UPRA frontera agrícola and GFW deforestation remain factual context information. ANT resguardos/consejos = factual information not scored (consulta previa = procedural step, same rule as the Mexican ejido).

Indicator	Value	Points	Reading
Protected areas (WDPA)	0 class	100	outside any protected area (none within 5 km)
Agricultural frontier — frontera agrícola (UPRA)	No condicionada	—	Agricultural frontier type at the point/area — land-use information, never a score.
Deforestation alerts (12 months, per km ²)	0 alerts/km ² /yr	—	Land/environmental pressure in the area — context for a PV project, not a solar feasibility criterion.

Territorial context — 43/100 (weight 5 % · effective 5 %)

Municipality security trend (SIEDCO) and population density — a utility-scale site looks for open land, a self-consumption rooftop the opposite; deliberately low weight.

Indicator	Value	Points	Reading
Homicides — YoY trend (SIEDCO)	120 %	15	sharply rising
Population density (area)	21 hab/km ²	85	sparsely populated rural area

Annex — collected data

Public data collected at the date of issue, presented as-is with its reading. Unavailable sources are flagged.

Nearby places (GeoNames)

place	region	country	population	distance_km
Quitapesares	Magdalena Department	Colombia	—	0.70
El Porvenir	Magdalena Department	Colombia	—	2.30
El Difícil	Magdalena Department	Colombia	—	20.90
Bosconia	Cesar Department	Colombia	40,562	22.20
San Ángel	Magdalena Department	Colombia	—	27.60

Elevation (Open-Meteo)

- 109 m: lowlands (tierra caliente) — hot climate

Field	Value
elevation_m	109

Seismicity (USGS)

- moderate seismicity: 41 M4+ earthquakes in 5 years within 300 km

Field	Value
count_m4plus_5y_300km	41

strongest

mag	date	place	depth_km
5.50	2022-02-23	26 km SW of Santa Rosa del Sur, Colombia	50.69
5.20	2023-07-30	near the north coast of Colombia	50.68
4.90	2026-03-01	5 km NW of Bochalema, Colombia	190.29
4.90	2024-05-12	65 km NNW of Dibulla, Colombia	10
4.70	2025-10-24	45 km E of Maicao, Colombia	96.56

Active fires (NASA FIRMS)

- no thermal hotspot detected over 5 days in the area

Field	Value
bbox	-74.55,9.35,-73.55,10.35
count_5days	0

Deforestation alerts (Global Forest Watch)

- no deforestation alert over 12 months in the 5×5 km box — no recent forest loss detected
- GFW integrated alerts (GLAD-L + GLAD-S2 + RADD, ~10 m): tree-cover loss detected by satellite — includes legal logging, fires and agricultural clearing

Field	Value
zone	boîte 5×5 km
since	2025-07-17
area_km2	25
period_days	365
alerts_total	0
latest_alert	—

Ongoing natural events (NASA EONET)

- no major ongoing natural event recorded by NASA in the area ($\pm 2^\circ$)

Soil (ISRIC SoilGrids)

- Acrisols : suelos ácidos lixiviados, baja fertilidad — encalado/fertilización a menudo necesarios
- pH 6: moderadamente ácido — rango adecuado para la mayoría de los cultivos
- buen contenido de materia orgánica (38.8 g/kg de carbono)
- textura arcillo-limosa (39% arcilla, 31.7% arena) — buena retención de agua
- datos SoilGrids 250 m (modelo global) — confirmar con análisis de suelo antes de cualquier proyecto agrícola

Field	Value
wrb_classification	Acrisols

properties_0_5cm

unit	property	value_0_5cm
g/kg	clay	39
cg/kg	nitrogen	3.01
pH	phh2o	6
g/kg	sand	31.70
dg/kg	soc	38.80

class_probabilities

class	probability_pct
Acrisols	15
Luvisols	13
Cambisols	12

Flood-proneness / surface water (JRC)

- No surface water detected over the area (JRC 1984-2021) — no sign of recurrent flooding.
- JRC Global Surface Water data (~30 m) — confirm with a local hydrological study.

Field	Value
tile	occurrence_80W_10Nv1_4_2021.tif
source	JRC Global Surface Water (occurrence 1984-2021, ~30 m)
resolution_m	30
valid_pixels	1,296
ever_water_pct	0
max_occurrence_pct	0
permanent_water_pct	0
mean_water_occurrence_pct	0

Land cover (ESA WorldCover 10 m)

- Land cover: 75.5% grassland · 23.9% tree cover · 0.6% shrubland.
- ESA WorldCover 10 m (2021) — dominant cover at satellite scale; does not detect scattered or recent built-up (the drone survey is the on-site reference).

Field	Value
tile	ESA_WorldCover_10m_2021_v200_N09W075_Map.tif
source	ESA WorldCover 10 m (2021, v200)
dominant	grassland
resolution_m	10
valid_pixels	11,664

classes

pct	code
75.50	grassland
23.90	tree
0.60	shrub

Population (WorldPop)

- density 21 inhab/km²: rural area
- WorldPop 2020 estimate (100 m grid) — current population may differ

Field	Value
year	2,020
zone	boîte 5×5 km
area_km2	25
density_per_km2	21
total_population	513

24-month climate (ERA5, Open-Meteo)

- 1,153 mm of precipitation over the last 12 months — abundant rainfall
- -37.4% vs the previous 12 months — marked year-on-year variation (compare with the NDVI curves)
- mean temperature 28.82 °C over 12 months (ERA5 reanalysis ~9 km — local microclimates may differ)

Field	Value
source	Open-Meteo Archive (réanalyse ERA5)
precip_yoy_pct	-37.40
temp_mean_12m_c	28.82
precip_last_12m_mm	1,152.70
precip_prev_12m_mm	1,841.10

months

month	precip_mm	temp_mean_c
2024-07	159.70	28.45
2024-08	246.90	27.54
2024-09	291.20	27.01
2024-10	222.30	26.83
2024-11	249.90	26.11
2024-12	39.20	28.48

... 24 entries in total.

Solar resource — climatology (NASA POWER)

- GHI ~1,989 kWh/m²/yr — very good resource — favourable for utility-scale solar
- very stable resource across the year (min/max month = 0.83) — steady production
- clear-sky index 0.83 (actual GHI / clear-sky GHI) — low cloud attenuation

Field	Value
source	NASA POWER (climatologie long terme, communauté RE)
temp_mean_c	29.52
clear_sky_index	0.83
dni_annual_kwh_m2	1,363
ghi_annual_kwh_m2	1,989
seasonality_min_max	0.83

months

month	temp_c	dni_kwh_m2_day	ghi_kwh_m2_day
JAN	29.75	5.35	5.55
FEB	31.19	4.89	5.86
MAR	31.64	3.54	5.66
APR	30.73	2.98	5.52
MAY	29.35	2.64	5.13
JUN	29.73	3.48	5.63

... 12 entries in total.

Photovoltaic yield (Global Solar Atlas)

- specific yield ~1,655 kWh/kWp/yr (Solargis PV simulation) — excellent specific yield
- optimal panel tilt: 13° (close to horizontal at these latitudes)

Field	Value
source	Global Solar Atlas 2.0 (Solargis, ESMAP, Banque mondiale)
temp_c	27.40
elevation_m	107
dni_kwh_m2_year	1,611.90
ghi_kwh_m2_year	2,073.80
optimal_tilt_deg	13
diffuse_kwh_m2_year	905
gti_opta_kwh_m2_year	2,117
pvout_specific_kwh_kwp_year	1,655

Terrain slope and aspect (Copernicus DEM)

- mean slope 0.8% (aspect NO) — nearly flat terrain — ideal for ground-mounted structures
- 90 m DEM estimate (Copernicus GLO-90) — pre-feasibility, does not replace a topographic survey

Field	Value
dem	Copernicus GLO-30 (COG AWS, 30 m)
grid	19×19 px (30 m)
zone	±300 m autour du point
source	Copernicus DEM GLO-30 (30 m), ajustement de plan sur 361 pixels
aspect_deg	318
roughness_m	3.40
slope_mean_deg	0.40
slope_mean_pct	0.80
aspect_cardinal	NO

Protected areas (WDPA)

- no WDPA protected area at the point or within 5 km
- WDPA database (UNEP-WCMC) — coverage of regional/local areas may be incomplete; local authorities are authoritative

Field	Value
source	WDPA — World Database on Protected Areas (UNEP-WCMC, via ArcGIS Living Atlas)
protection_class	0

Power grid (OpenStreetMap)

Field	Value
source	OpenStreetMap (Overpass) — infrastructure électrique cartographiée par la communauté ; complétude variable selon les zones
nearest_line_km	20.80
lines_within_25km	4
max_tension_kv_50km	500
nearest_substation_km	36.40
substations_within_50km	4

substations_top5

name	operator	tension_kv	distance_km
Parque Fotovoltaico El Paso	—	—	36.40
Subestacion El Copey	—	500	36.80
—	Afinia	—	37.70
Subestacion El Paso	—	110	37.80

Photovoltaic production (PVGIS © EU)

Field	Value
source	PVGIS © Union européenne (JRC) — re.jrc.ec.europa.eu ; simulation indicative, pas une étude d'ingénierie
annual_kwh	2,922
kwh_per_kwp	292
loss_aoi_pct	—
radiation_db	PVGIS-ERA5
loss_temp_pct	—
slope_used_deg	15
total_loss_pct	—
angles_optimized	no
azimuth_used_deg	0
loss_spectral_pct	—
monthly_irradiation	—
year_variability_kwh	—
inplane_irradiation_kwh_m2	—

horizon_profile

A	H_hor
-180	0
-172.50	0
-165	0
-157.50	0
-150	0
-142.50	0

... 49 entries in total.

sun_path_summer

A_sun(s)	H_sun(s)
-180	0
-167.70	0
-156.40	0
-146.80	0

-139	0
-132.80	0

... 49 entries in total.

sun_path_winter

A_sun(w)	H_sun(w)
0	0
-26.80	0
-44.60	0
-54.90	0
-60.80	0
-64.40	0

... 49 entries in total.

Crime (SIEDCO, Colombia)

- homicides rising: 11 in 2025 vs 5 in 2024 (+120%)
- 10 homicides already recorded in 2026 (partial year)
- figures at the whole-municipality level — not the immediate vicinity of the point

Field	Value
source	Policía Nacional SIEDCO via datos.gov.co
municipio	Ariguaní

thefts

year	count
2,026	0
2,025	7

homicides_by_year

year	count
2,026	10
2,025	11
2,024	5
2,023	9

Agricultural suitability and frontera agrícola (UPRA, Colombia)

- land within the frontera agrícola nacional (No condicionada) — area where agricultural activity is recognized by the Colombian State
- crop “null” has no dedicated UPRA suitability layer — only the frontera agrícola is assessed

Field	Value
zone	point
source	UPRA / SIPRA (sig.upra.gov.co, geoservicios.upra.gov.co)

Power grid connection (UPME, Colombia)

- nearest substation: Copey 220 kV at 36.7 km (220 kV) — heavy connection — nearest substation is far
- 13 project(s) with UPME-assigned capacity within 50 km (969.2 MW incl. 969.2 MW solar) — check available capacity at the targeted connection point
- actual connection capacity depends on the UPME/operator connection study — these distances are indicative

Field	Value
source	UPME — geo.upme.gov.co (sistema de transmisión construido, capacidad asignada)
nearest_line_km	8.10
lines_within_25km	1
max_tension_kv_50km	500
nearest_substation_km	36.70
substations_within_50km	4

substations_top5

name	owner	sistema	municipio	tension_kv	distance_km
Copey 220 kV	TRANSELCA	STN	EL COPEY	220	36.70
Copey 500 kV	INTERCONEXIÓN ELÉCTRICA S.A E.S.P.	STN	EL COPEY	500	36.90
Copey 110 kV	CARIBE MAR DE LA COSTA S.A. E.S.P.	STR	EL COPEY	110	36.90
El Paso 110 kV	CARIBE MAR DE LA COSTA S.A. E.S.P.	STR	EL PASO	110	37.80

Methodology & limits

This report is a **solar photovoltaic pre-feasibility** based on public data (NASA POWER, Global Solar Atlas — Solargis/ESMAP/World Bank, Copernicus GLO-90 DEM, UPME, NASA FIRMS/EONET, USGS, Global Forest Watch, WorldPop, SIEDCO — sources cited in each section). The weighted grid is traceable — solar resource 30%, grid connection 25%, terrain 15%, climate & risks 15%, land context 10%, socio-economic context 5% — and each indicator shows its observed value, the points assigned and the reading rule. The verdict (FAVORABLE / CONDITIONAL / UNFAVORABLE) is exclusively a **weighted aggregate**: no single indicator can downgrade the site on its own — connection distances and resource thresholds are indicative, never disqualifying. Dimensions without available data are excluded from the total with weight renormalization. This pre-feasibility replaces neither the connection study with UPME and the grid operator, nor the on-site measurement campaign, nor the topographic survey.

Disclaimer. DataTerra provides a **red-flag pre-screening** based exclusively on public data available at the date of issue. This document is neither legal advice, nor a land survey, nor due diligence: it does not replace the verification of titles and easements with official registries, nor the support of a local lawyer or notary, which we expressly recommend before any commitment. Third-party data may contain errors or update delays; DataTerra cannot be held liable for decisions made solely on the basis of this document.