PVMath

From site to system.

Pre-Engineering Automation for Utility-Scale Solar

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PVMath — Project Intelligence Report

SiteIQ · TerrainIQ · LayoutIQ · YieldIQ · RevenueIQ

PROJECT SUMMARY

Project	Sample Project
Location	Osten, Cuxhaven, Lower Saxony, Germany
Coordinates	53.73300°N, 9.18800°E
Site area	168.6 ha
Land use	Standard
Mounting	Single-Axis Tracker
Capacity from LayoutIQ	~118 MWp DC
Generated	2026-08-11 14:03 UTC

SITEIQ

SOLAR

Good

1042 kWh/m²/yr — fixed-tilt POA @ 35° (SiteIQ screening; tracker POA in YieldIQ)

FLOOD

High

Coastal Lower Saxony — elevated flood screening flag

GRID PROXIMITY

Moderate

Verify interconnection with local DSO

Regional HV · 12.0 km · 110 kV

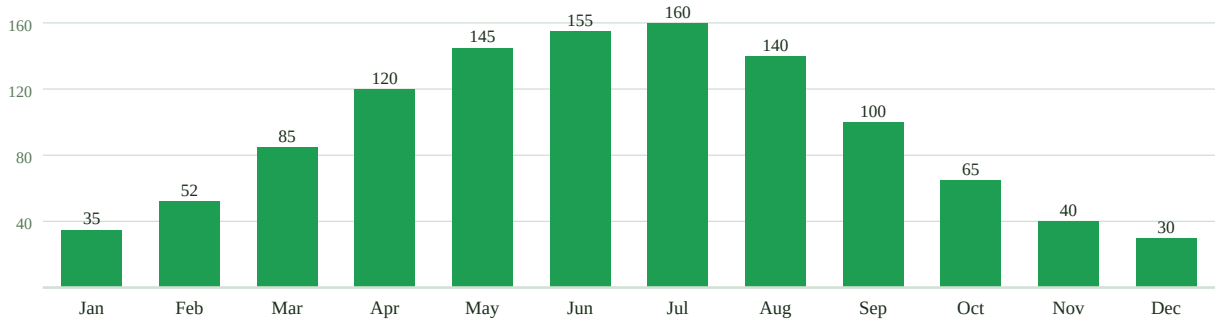
REGULATORY

EEG Freifläche screening

Germany — confirm local zoning and EEG eligibility.

Grid proximity from OpenStreetMap — verify with DSO before FEED.

MONTHLY SOLAR IRRADIATION (kWh/m²)



Peak month: Jul (160 kWh/m²) | Annual total: 1127 kWh/m²

TERRAINIQ

Slope Map

Slope map not embedded — use TerrainIQ in the app for the interactive map, or re-export after TerrainIQ completes with a valid site boundary.

Slope Distribution

Slope range	% of site area
0° – 2.5°	0.0%
2.5° – 5°	0.0%
5° – 7.5°	0.0%
7.5° – 10°	0.0%
10° – 20°	0.0%

Terrain Metrics

Parameter	Value	Notes
Min elevation	-6 m	Lowest grid point in boundary
Max elevation	-2 m	Highest grid point in boundary
Elevation range	4 m	Relief across site (DEM accuracy ±1–3 m)
Mean slope	0.2°	Average gradient (degrees)
Max slope (point)	1.4°	Steepest single grid cell
Area > 5° slope	0.0%	≈0.0 ha · cumulative footprint above threshold
Area > 10° slope	0.0%	≈0.0 ha · max point 1.4° may be a small sliver

Engineering Verdict

Fixed Tilt	Single-Axis Tracker
Excellent Terrain (Fixed Tilt)	**Excellent Terrain (Tracker)**
Mean slope 0.2° — within fixed-tilt excellent threshold (≤2.9°).	Mean slope 0.2° — within tracker excellent threshold (≤1.7°).

Both mounting systems assessed from the same DEM slope data. Cross-row metrics above apply to tracker screening.

Terrain Drivers

Terrain Score: 99/100 (Excellent)

Driver	Impact
Mean slope 0.2°	+ Strong positive
0.0% of site below 2.5° slope	Moderate
0.0% of site below 5° slope	! Moderate
Maximum slope 1.4°	+ Within screening limits

Why this verdict?

+ Terrain suitable for utility-scale fixed tilt

+ Terrain suitable for single-axis trackers
+ No grading needed
! LiDAR survey required before FEED and pile design

Slope Threshold Reference

Fixed tilt	Threshold	Interpretation
Excellent	≤ 2.9°	Ideal for fixed-tilt ground mount
Acceptable	≤ 5.7°	Feasible; some earthworks expected
Challenging	≤ 8.5°	Significant earthworks required
Critical	> 8.5°	Likely not viable without major grading

Single-axis tracker	Threshold	Interpretation
Excellent	≤ 1.7°	Ideal for single-axis tracker
Acceptable	≤ 3.4°	Feasible; grading may be needed
Challenging	≤ 5.7°	Steep for trackers; civil study required
Critical	> 5.7°	Too steep for standard tracker layout

LAYOUTIQ

Selected layout from the pitch sweep — same figures as the A1 layout sheet in the project package.

Configuration	SAT 2P
Pitch / GCR / row width	12.05 m · GCR 0.41 · physical row width 4.94 m
DC capacity	118,373.0 kWp (118.37 MWp)
Modules	182,112
Strings	3,252
Rows	555
Site area	168.619 ha
Density	0.702 MWp/ha

Wind exposure (screening)

External strings	753
Internal strings	2,499
External share	23.2%

Red = external (wind-exposed); green = internal (sheltered). Screening-grade only — not structural or bankable wind design.

Tracker row geometry (screening)

Single-axis tracker screening uses the physical row envelope at maximum rotation (module stack shadow arc plus cable margin), not the flat module stack width alone, for row pitch, GCR, and YieldIQ shading. This matches typical EPC row-spacing practice for feasibility and early layout studies.

Re-run LayoutIQ on the current platform version to populate rotation geometry for this tracker layout.

YIELDIQ

SCREENING SUMMARY

Configuration Single-Axis Tracker — double portrait (2P)	**Specific yield** 1224 kWh/kWp/yr	**Annual energy** 144889 MWh/yr
Performance ratio 86.8%	**Capacity factor** 14.0%	**POA irradiance** 1,410 kWh/m²/yr
Total loss 13.2%	**Shading (GCR)** 4.0%	**Temperature** 3.5%
Soiling + BOS 8.0%	**Peak month** Jun (102 kWh/kWp)	**Low month** Jan (84 kWh/kWp)

SOLAR RESOURCE

GHI (horizontal) — kWh/m²/yr	**DNI (direct normal)** — kWh/m²/yr	**DHI (diffuse horizontal)** — kWh/m²/yr

PERFORMANCE — PLANE-OF-ARRAY IRRADIANCE

Fixed-tilt POA 1,164 kWh/m²/yr	**Tracker POA** 1,410 kWh/m²/yr
Tracker POA gain vs fixed +21.1%	

SiteIQ solar card shows fixed-tilt POA @ PVGIS optimal tilt — not tracker POA. Values above use the YieldIQ analysis profile at project GCR.

LOSSES BREAKDOWN — 2P Tracker (selected)

Shading 4.0%	**Temperature** 3.5%	**Soiling** 2.0%	**Other (BOS + wiring)** 6.0%	**Total loss** 13.2%

Temperature is PVGIS physics-based. Shading + soiling + other (BOS, wiring, mismatch) sum to total loss with temperature, AOI, and spectral effects.

TRACKER GAIN

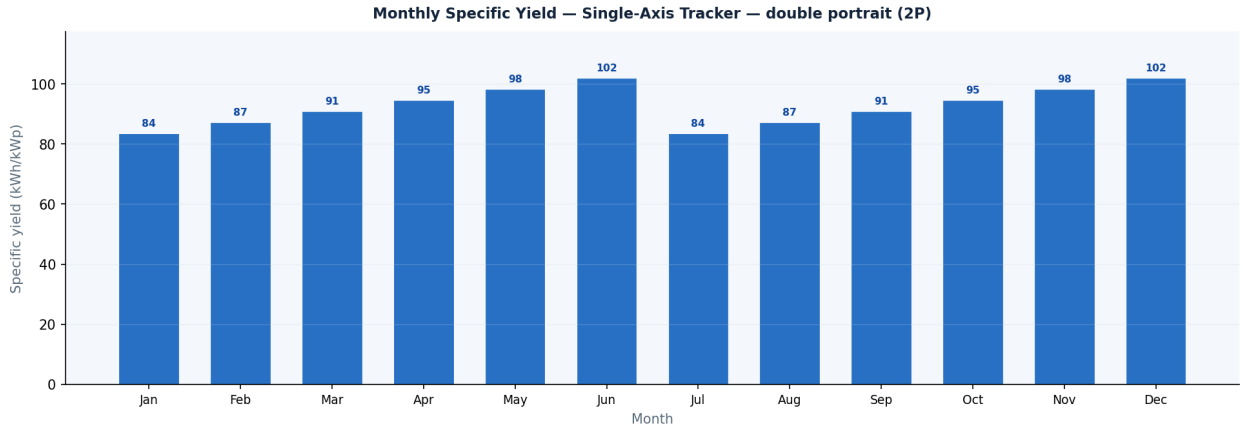
Tracker gain (2P)

+214 kWh/kWp/yr (21.2%) · SAT 1,224 vs FT 1,010 @ GCR 0.41

Gain is each tracker versus the fixed-tilt configuration at the same GCR and loss assumptions. This baseline differs from the cross-module reference above (1P at default GCR), so the two fixed-tilt figures need not match.

Single-Axis Tracker: modules follow the sun on a horizontal N–S axis (0° axis tilt) — fixed optimal tilt does not apply. PVGIS two-axis irradiance is used for the tracker yield.

MONTHLY SPECIFIC YIELD (kWh/kWp)



Specific yield per month for the selected configuration (PVGIS analysis profile).

PVGIS radiation database: PVGIS-SARAH2

REVENUEIQ

All figures are screening bands (low / high), not point estimates.

CAPEX BREAKDOWN

Component	Low	High	€/Wp DC
PV modules	€ 0 k	€ 0 k	—
Inverters / power conversion	€ 0 k	€ 0 k	—
Mounting structure	€ 0 k	€ 0 k	—
DC cabling + combiner	€ 0 k	€ 0 k	—
AC cabling + MV transformer	€ 0 k	€ 0 k	—
Civil works / earthworks	€ 0 k	€ 0 k	—
Grid connection	€ 0 k	€ 0 k	—
Engineering (FEED, detailed)	€ 0 k	€ 0 k	—
Permitting + development	€ 0 k	€ 0 k	—
Commissioning + testing	€ 0 k	€ 0 k	—
Gross total CAPEX	€ 64.00 M	€ 103.00 M	—

Grid connection band depends on substation distance, voltage level, DSO requirements, and whether a new bay or full substation is required.

ANNUAL OPEX

Item	Low / yr	High / yr
O&M + land + insurance + asset mgmt + grid fees	€ 1 420 k	€ 1 894 k
Local currency	EUR 1 420 k	EUR 1 894 k

REVENUE MODEL

Field	Value
Tariff mode	auction
Tariff band	€ 45–65 /MWh (EUR None–None/MWh)
Year 1 revenue band	€ 6.50–9.40 M / yr
25-year cumulative revenue	€ 0.00 M

FINANCIAL INDICATORS (INDICATIVE)

Metric	Low	High
LCOE	€ 25.0 /MWh	€ 42.0 /MWh
Simple payback	8 yr	19 yr
Project IRR	-2.6%	4.8%
NPV @ 6.5% WACC	€ -12.00 M	€ 8.00 M

SENSITIVITY (±10% impact on Project IRR)

Variable	±10% shift	IRR Δ (pp)	Flag
Energy yield (MWh/yr)	±10%	0.0 pp	—
Total CAPEX	±10%	0.0 pp	—
Tariff / PPA rate	±10%	0.0 pp	—
OPEX	±10%	0.0 pp	—

ECONOMIC VIABILITY

MARGINAL

Indicative screening — not investment advice.

RevenueIQ provides indicative financial screening only. CAPEX ranges are based on global benchmark data (2025–2026) adjusted for technology type, mount system, country, market conditions, and TerrainIQ grading where available; actual costs depend on site conditions, supply chain, and competitive EPC tender results. Civil works includes roads, drainage, fencing, and foundations on every site — cut/fill earthworks are discounted when TerrainIQ reports no grading needed. Revenue figures use indicative tariff and PPA benchmark rates — government auction projects must win the applicable tender round, and PPA rates depend on offtaker credit and market conditions at the time of contract. US ITC figures are indicative; eligibility and percentage depend on compliance with IRA 2022 requirements. All financial metrics (IRR, NPV, LCOE, payback) are screening-grade estimates only and are not bankable yield assessments. Engage a certified financial advisor and independent engineer before making any financial close or investment decision.

PVMATH SCORE

PVMATH SITE RATING

Full composite includes YieldIQ energy yield (regional benchmark). Includes economic viability from RevenueIQ where available. Terrain caps the score on challenging sites. DC capacity is from LayoutIQ.

73/100

GOOD

★★★★★ High Confidence

Qualitative rating	GOOD
Screening confidence	★★★★★ High Confidence
Investment risk	Medium-High
Utility-scale PV recommended	YES

PVMath site rating scale

73/100 · GOOD

0 — Poor

100 — Excellent

Composite score = sum of factor score × weight (rounded). See contribution column.

Screening confidence scale

High Confidence

Screening only

High confidence

Reflects data completeness across workflow modules — not a bankable IE sign-off.

Factor	Score	Weight	Contribution
Grid / Regulatory	78/100	18%	14 pts
Terrain	99/100	18%	18 pts
Energy Yield	71/100	16%	11 pts
Land Use	85/100	13%	11 pts
Flood Risk	40/100	10%	4 pts
Solar Resource	72/100	5%	4 pts
Economic viability	55/100	20%	11 pts
Composite total	**73/100**	**100%**	**73 pts (rounded)**

RECOMMENDED NEXT STEPS

Synthesized across SiteIQ, TerrainIQ, LayoutIQ, YieldIQ, and RevenueIQ — priority actions following the PVMath site rating above.

Regulatory & Permitting

• Verify land classification (Nutzungsart) with local Katasteramt
• Grid connection: contact local DSO (e.g. Bayernwerk, E.ON, Netze BW)
• Planning permission: consult local Bauamt / Gemeindeverwaltung
• EEG 2023: ground-mount >1 MWp must bid in the BNetzA Ausschreibung (competitive tender, Solar-Freifläche) — register the project in the Marktstammdatenregister and track tender rounds at bundesnetzagentur.de
• Flood risk: www.hochwasserportal.de — verify HQ100 flood zone

Engineering & Survey

• LiDAR survey required before FEED and pile design
• Confirm actual module specification with intended vendor before BOM finalization
• Complete detail design and 3D engineering study to produce tender-grade BOM before committing — LayoutIQ screening layout is not construction-ready

Financial & Procurement

• Commission bankable yield modelling (PVsyst or independent engineer) before financial close.
• Indicative screening — not investment advice.
• Engage a certified financial advisor and independent engineer before financial close

DISCLAIMERS & REFERENCE

This report provides preliminary site screening for internal go/no-go and early client discussions only. Solar data from PVGIS JRC; terrain from satellite DEM (indicative unless TerrainIQ-confirmed); flood risk is an elevation heuristic, not hydraulic modelling; regulatory flags are indicative OSM-based checks, not permitting diligence. PVMath does not claim bankability. A full engineering study, site survey, permitting review, and certified energy yield assessment are required before financing, EPC contract, or final investment decision.

ANNEX — SCREENING METRICS EXPLAINED

Key Metrics ratings are screening thresholds for early go/no-go — not bankability or permitting approval. Slope threshold reference tables appear in the TerrainIQ section above.

Topic	Summary
Solar resource	PVGIS plane-of-array irradiance and specific yield — screening-grade; see YieldIQ for configuration comparison.
Terrain	Public DEM slope and elevation — indicative; LiDAR/GNSS required for design.
Capacity & yield	DC capacity and MWh from LayoutIQ + YieldIQ on the selected configuration.
Knowledge Centre	Full metric definitions: pvmath.com/guides — SiteIQ screening, TerrainIQ terrain, YieldIQ yield methodology.

ANNEX — REVENUEIQ METHODOLOGY & ASSUMPTIONS

Topic	Summary
Inputs	DC capacity and annual MWh from LayoutIQ + YieldIQ; country, land use, and grid context.

CAPEX / OPEX	Global benchmark bands (€/kWp) — low/high ranges; civil works uses TerrainIQ grading when available (site base + earthworks premium).
Finance KPIs	25-yr life, WACC 6.5%, screening IRR/NPV/LCOE — not bankable.
Knowledge Centre	Full methodology: pvmath.com/guides/revenueiq-screening.html · CAPEX & tariffs: pvmath.com/guides/revenueiq-capex-tariffs.html

ANNEX — DESIGN BASIS (SCREENING)

Indicative assumptions for this report — not a detailed design basis memorandum. Engage an IE for bankable studies.

Parameter	Assumption
PV module	650 Wp · 1.038 × 2.094 m
Modules per string	28
Total strings	3,252
Portrait count	1P
Mount type	Single-Axis Tracker
Pitch / table GCR	12.05 m / 0.41
PVGIS radiation database	PVGIS-ERA5 / SARAH (auto-routed)
Transposition model	PVGIS v5.2 (JRC) — Perez model
Albedo / bifacial gain	Not modelled in screening (monofacial default)
DC:AC ratio	~1.2 (power-based inverter sizing)
Wind / snow load region	Not modelled — structural design required

Loss assumptions

Item	Value
SiteIQ screening loss	14% flat (no row shading)
YieldIQ soiling	2.0%
YieldIQ other (BOS, wiring, mismatch)	6.0%
Row shading model	Physical row width at max rotation + simplified backtracking (rotation-limited)
Temperature / AOI / spectral	PVGIS physics (analysis profile)
Tracker rotation limits	±60° (screening / user input)
Ground clearance	0.65 m min @ max rotation (screening)

Verdict scale: Excellent > Very Good > Good > Acceptable > Challenging > Critical