

DATA AND TOOLS TO SUPPORT GEOSPATIAL PLANNING FOR RE DEVELOPMENT

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WORLD BANK GROUP

THE WORLD BANK
IBRD • IDA

IFC

International
Finance Corporation



Energy Sector Management Assistance Program

Key factors in RE planning

- Where are the resources and how good are they?
- How do they correspond to demand/supply?
- How should RE zones/sites be prioritized?
- What are the short-term vs long-term opportunities?

➤ **REQUIRES DATA AND MODELING TOOLS**

Global Solar Atlas

GLOBAL SOLAR ATLAS

GLOBAL WIND ATLAS | ENERGYDATA.INFO

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Map Info

Photovoltaic electricity output

PVOUT map © 2019 Solargis

- ☒ Solar Measurement Sites
- ☐ Hydro-connected Solar PV potential

Site Info

Search

-20.632784, -66.79623

Uyuni (Thola Pampa), Potosí, Bolivia

Site Data

PV Power Calculator

PVOUT ⚡ 2318 kWh/kWp per year

GHI 2657 kWh/m² per year

DNI 3415 kWh/m² per year

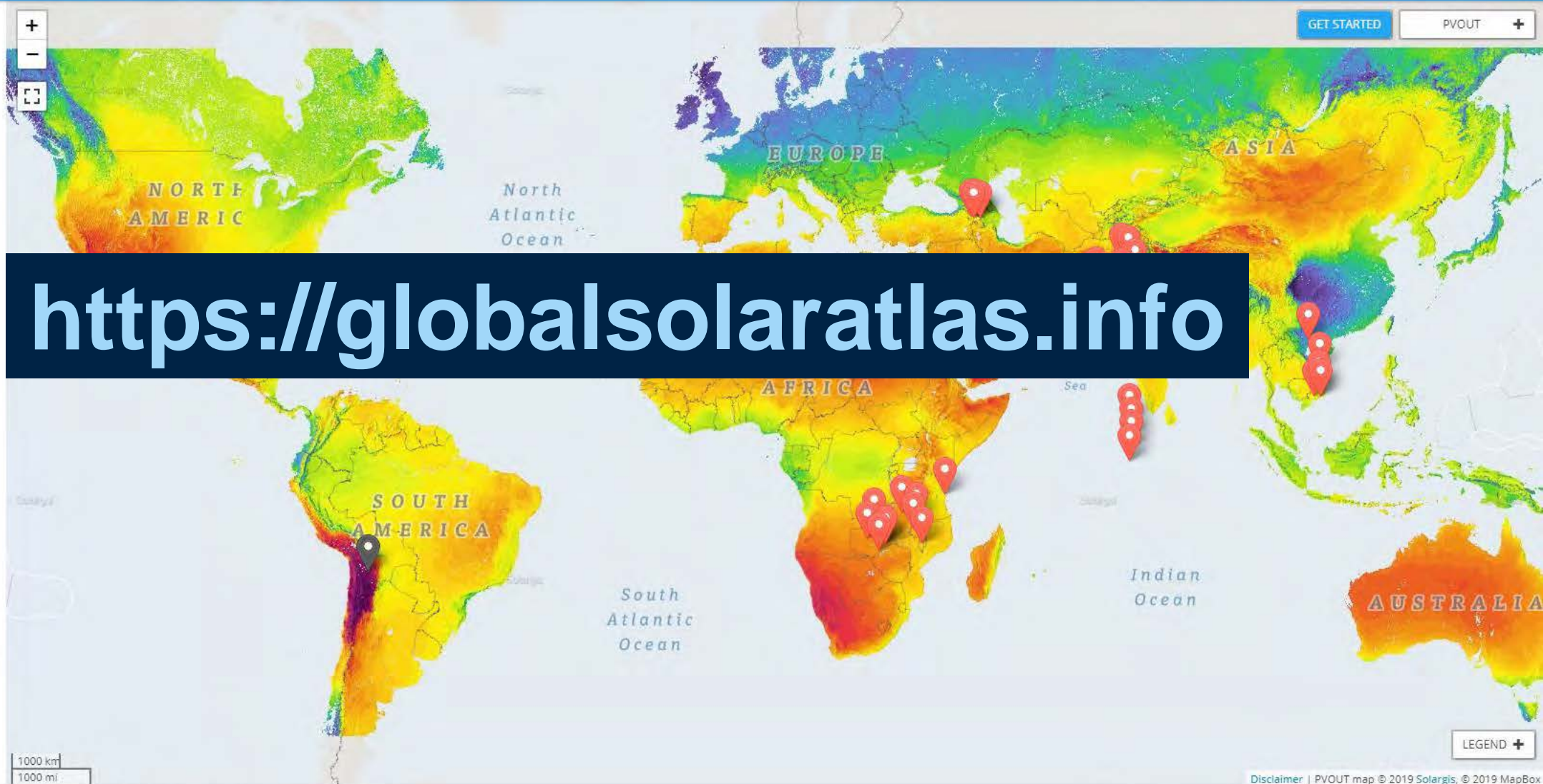
DIF 470 kWh/m² per year

GTI 2853 kWh/m² per year

OPTA 23° / 0°

TEMP 8.2 °C

ELE 3665 m



<https://globalsolaratlas.info>

Disclaimer | PVO map © 2019 Solargis, © 2019 MapBox

Global Wind Atlas

GLOBAL WIND ATLAS
GLOBAL SOLAR ATLAS | ENERGYDATA.INFO

Search Locations

Q

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Help ?

Power Density

Explanatory Layers

Wind Measurement Stations

1000 km

1000 mi

65.51296 : 60.46875

EUROPE

AFRICA

SOUTH AMERICA

North Atlantic

Arabian Sea

South Atlantic Ocean

850

800

750

700

650

600

550

500

450

400

375

350

325

300

275

250

225

200

175

150

125

100

75

50

<25

m

200

100

50

Leaflet | GWA 2.0 © 2017 | Powered by nazka maps | Disclaimer

CUSTOMIZED AREAS

COUNTRY AND REGIONS

POINT (10*10 KM)

RECTANGLE

POLYGON

Welcome to the Global Wind Atlas.

Immediately start exploring windy areas by

clicking on the map

Draw points, rectangles and polygons by clicking

buttons above

by & region by selecting

regions" tab

KEY FEATURES

RELEASE NOTES

HELP

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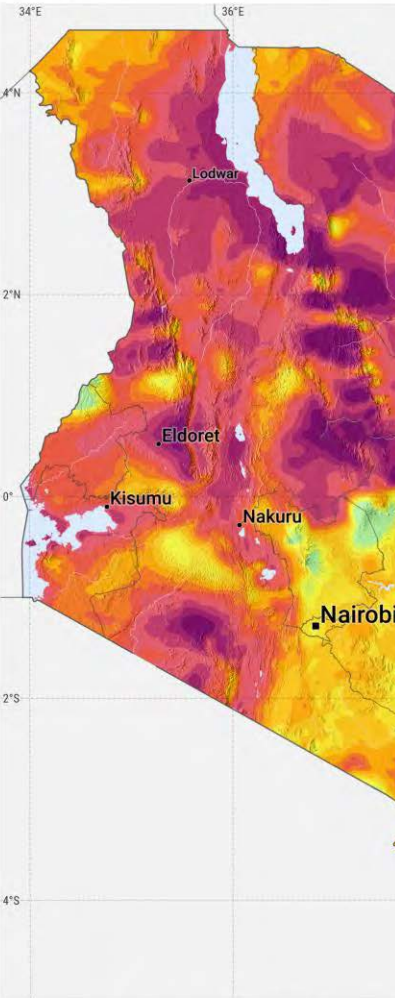
ESMAP

DTU
Technical University
of Denmark

VORTEX

Poster Maps

SOLAR RESOURCE MAP
PHOTOVOLTAIC POWER POTENTIAL
KENYA

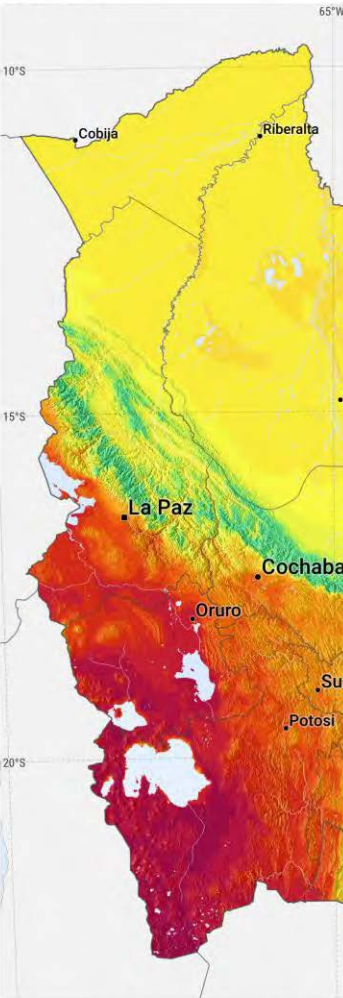


Long term average of PVO_{UT}, period 1994-2019

Daily totals:	4.0	4.2	4.4	4.6
Yearly totals:	1461	1534	1607	1680

This map is published by the World Bank Group, funded by ESMAP, and prepared by DTU Wind Energy.

SOLAR RESOURCE MAP
GLOBAL HORIZONTAL IRRADIANCE
BOLIVIA

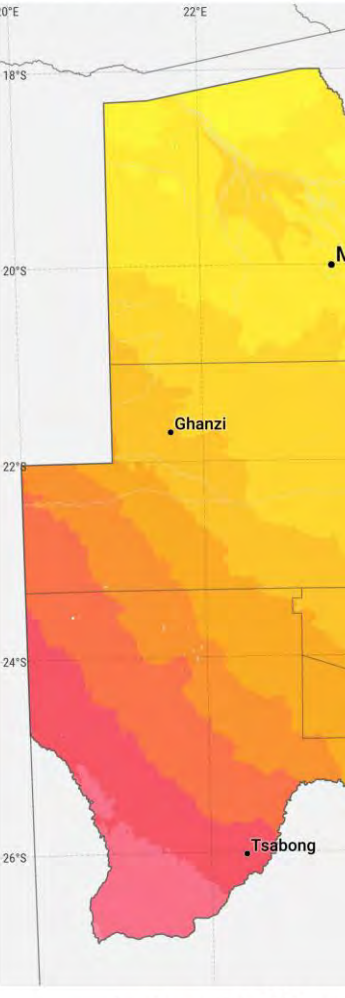


Long term average of GHI, period 1994-2019

Daily totals:	4.2	4.6	5.0	5.4
Yearly totals:	1534	1680	1826	1972

This map is published by the World Bank Group, funded by ESMAP, and prepared by DTU Wind Energy.

SOLAR RESOURCE MAP
DIRECT NORMAL IRRADIANCE
BOTSWANA

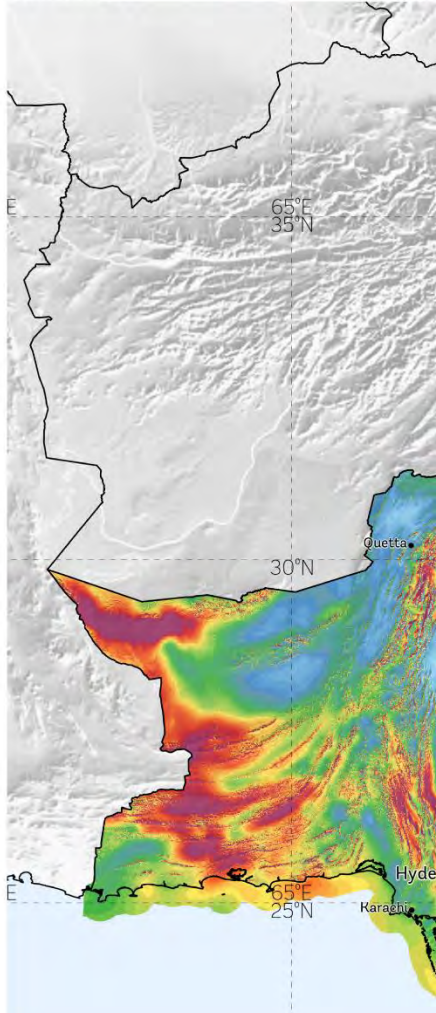


Long term average of DNI, period 1994-2019

Daily totals:	5.8	6.2	6.6
Yearly totals:	2118	2264	2410

This map is published by the World Bank Group, funded by ESMAP, and prepared by DTU Wind Energy.

ONSHORE & OFFSHORE WIND RESOURCE MAP
WIND POWER DENSITY POTENTIAL
PAKISTAN



Long term average of WPD, period 1994-2019

Daily totals:	5.8	6.2	6.6
Yearly totals:	2118	2264	2410

This map is published by the World Bank Group, funded by ESMAP, and prepared by DTU Wind Energy.

ONSHORE & OFFSHORE WIND RESOURCE MAP
WIND SPEED
VIETNAM



Long term average of WPD, period 1994-2019

Daily totals:	5.8	6.2	6.6
Yearly totals:	2118	2264	2410

This map is published by the World Bank Group, funded by ESMAP, and prepared by DTU Wind Energy.

COMING SOON: Hourly profile data!

- Overview
- PV configuratic
- Hourly profiles**
- Economy
- Reports

Predicted hourly and monthly energy production as a percentage of mean annual energy production

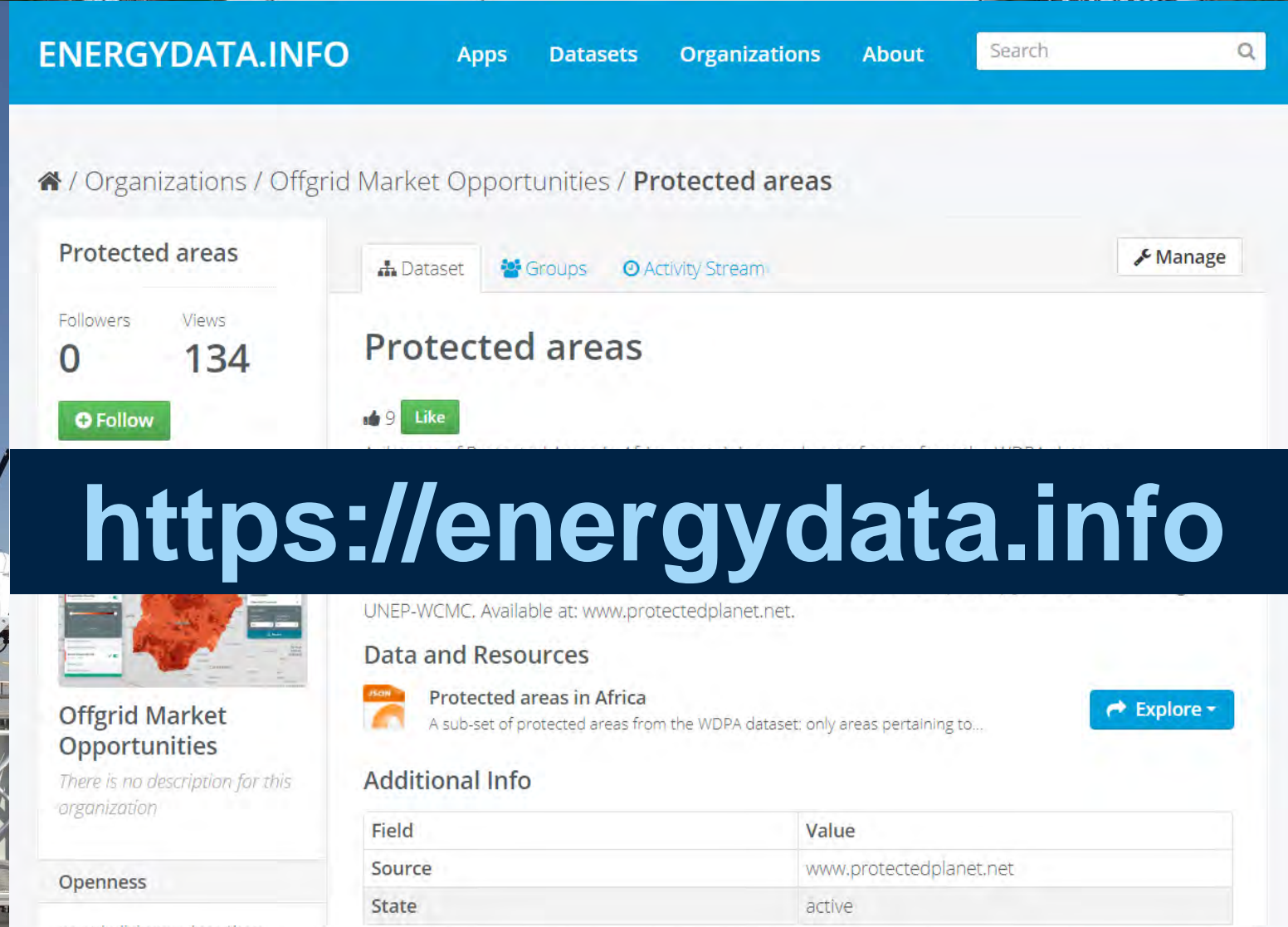
Generic 3MW power curve at 100 m agl

Energy production [%]

Latitude : -15.354

Longitude: 29.070

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0:00	0.239	0.316	0.469	0.562	0.499	0.502	0.555	0.631	0.68	0.743	0.545	0.361
1:00	0.249	0.333	0.487	0.596	0.534	0.542	0.6	0.662	0.712	0.751	0.549	0.36
2:00	0.233	0.345	0.517	0.62	0.557	0.564	0.62	0.683	0.717	0.744	0.549	0.349
3:00	0.236	0.341	0.525	0.642	0.601	0.599	0.653	0.704	0.694	0.705	0.547	0.346
4:00	0.254	0.365	0.549	0.68	0.633	0.609	0.684	0.718	0.693	0.697	0.54	0.367
5:00	0.24	0.338	0.529	0.673	0.644	0.613	0.694	0.704	0.656	0.647	0.482	0.319
6:00	0.171	0.259	0.424	0.6	0.569	0.542	0.646	0.614	0.55	0.515	0.377	0.237
7:00	0.121	0.193	0.34	0.517	0.503	0.475	0.585	0.508	0.459	0.422	0.3	0.183
8:00	0.087	0.133	0.251	0.407	0.386	0.389	0.493	0.403	0.37	0.338	0.231	0.14
9:00	0.07	0.098	0.173	0.309	0.281	0.302	0.394	0.316	0.287	0.263	0.178	0.106
10:00	0.063	0.075	0.127	0.224	0.204	0.225	0.292	0.236	0.223	0.203	0.138	0.084
11:00	0.057	0.062	0.103	0.174	0.159	0.178	0.228	0.19	0.187	0.173	0.122	0.076
12:00	0.055	0.057	0.091	0.145	0.132	0.154	0.189	0.165	0.18	0.165	0.119	0.067
13:00	0.056	0.06	0.093	0.138	0.125	0.146	0.178	0.162	0.184	0.177	0.124	0.07
14:00	0.066	0.078	0.107	0.145	0.128	0.139	0.175	0.162	0.187	0.198	0.147	0.093
15:00	0.08	0.091	0.122	0.149	0.133	0.14	0.175	0.165	0.187	0.198	0.153	0.097
16:00	0.101	0.121	0.157	0.186	0.178	0.177	0.199	0.197	0.209	0.232	0.18	0.136
17:00	0.146	0.174	0.221	0.265	0.273	0.263	0.282	0.311	0.292	0.296	0.222	0.182
18:00	0.178	0.201	0.286	0.344	0.344	0.341	0.363	0.403	0.404	0.426	0.28	0.228
19:00	0.203	0.243	0.332	0.403	0.398	0.399	0.422	0.464	0.48	0.52	0.358	0.278
20:00	0.235	0.256	0.372	0.448	0.42	0.428	0.456	0.503	0.532	0.576	0.415	0.307
21:00	0.209	0.251	0.39	0.477	0.434	0.432	0.467	0.532	0.587	0.634	0.429	0.299
22:00	0.207	0.273	0.418	0.501	0.447	0.449	0.483	0.572	0.618	0.68	0.47	0.307
23:00	0.206	0.281	0.421	0.521	0.451	0.467	0.512	0.594	0.656	0.711	0.499	0.315



ENERGYDATA.INFO Apps Datasets Organizations About Search

Home / Organizations / Offgrid Market Opportunities / **Protected areas**

Protected areas Dataset Groups Activity Stream Manage

Followers: 0 Views: 134 [Follow](#)

Protected areas 9 Likes

[https://energydata.info](#)

Offgrid Market Opportunities
There is no description for this organization

Openness

UNEP-WCMC. Available at: www.protectedplanet.net.

Data and Resources

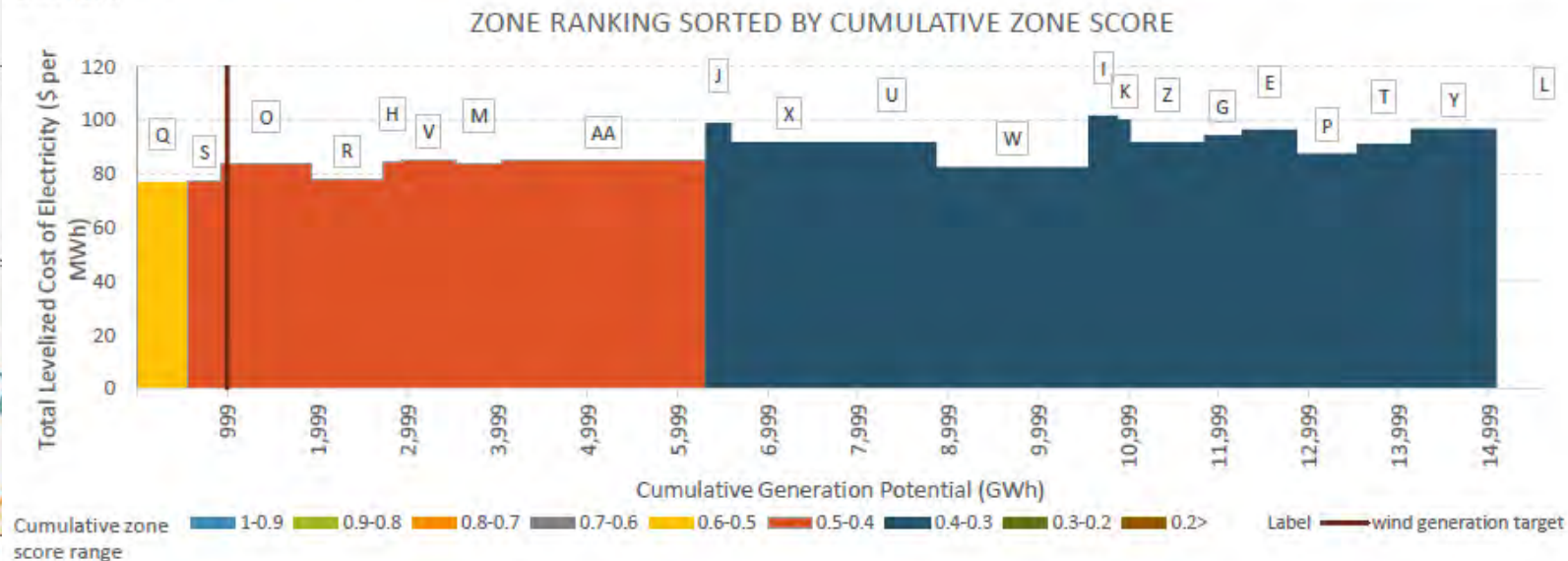
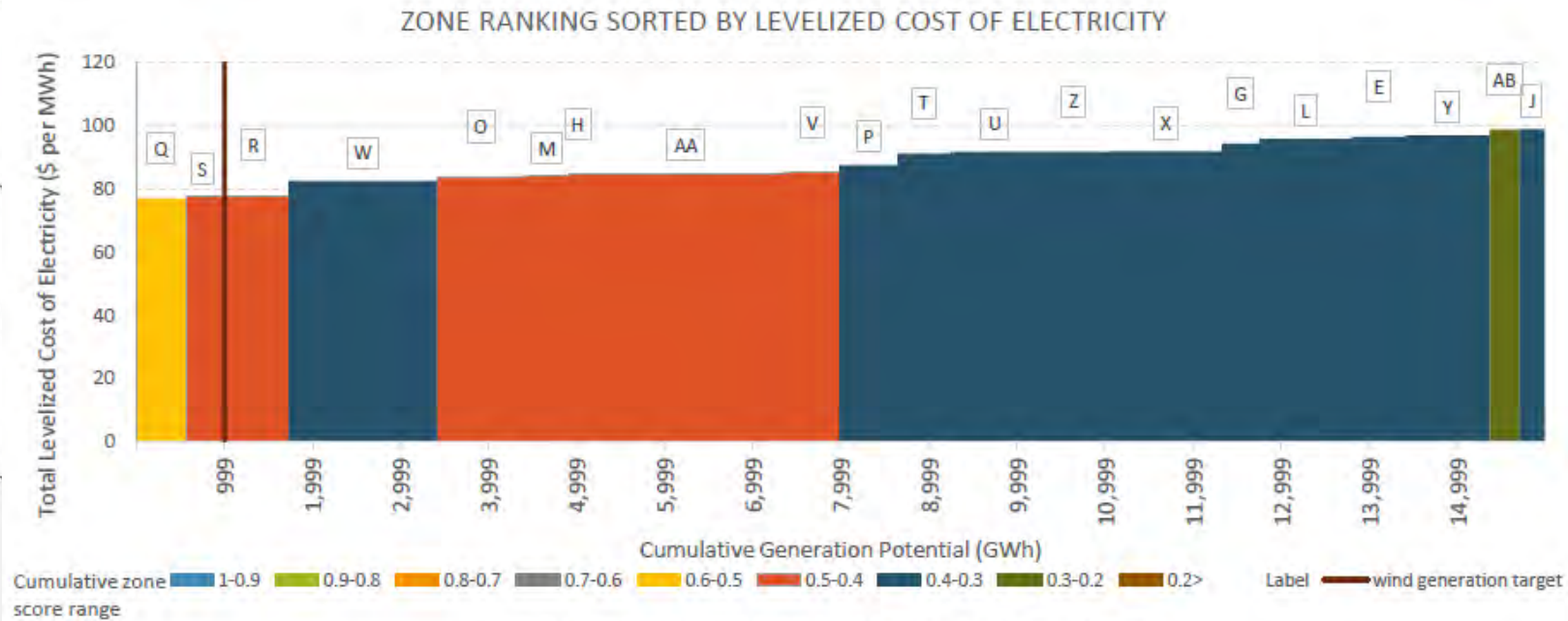
[Protected areas in Africa](#)
A sub-set of protected areas from the WDPA dataset: only areas pertaining to...

[Explore](#)

Additional Info

Field	Value
Source	www.protectedplanet.net
State	active

GIS Analysis



COMING SOON: New Apps!

Africa Electricity Grids Explorer ⓘ

Technical Rooftop Solar PV Potent

Select Area of Interest ▾

Hồ Chí Minh city

☒ Commune

Peak Capacity ▾

☐ Rooftops

☒ Rooftops > 500m² polygon

Bà Điểm

Hóc Môn

Element for selected commune

Value

Peak Capacity (yearly average)

169.22 MW

PV optimal

482 810 MWh/ye

PV tilted

455 453 MWh/ye

PV horizontal

474 523 MWh/ye

PV optimal/m²

68.64 kWh/m²/ye

Commune total area

7.03 km²

Home About ▾ Download Contact Help ? English ▾

Site | Region | Hyrdo-connected

Max PV capacity

Reservoir height

Sort by ▾

Oyon

07°15'33", 03°15'19"

Nigeria

Purpose: Hydropower

Status: Operational since 1983

PVOUT: 1311 kWh/m² per year

Max PV Potential based on surface area: 400 MW

Akosombo

06°21'00", 00°06'00"

Ghana

Purpose: Hydropower

Status: Operational since 1965

PVOUT: 1404 kWh/m² per year

Max PV Potential based on surface area: 81822.5 MW

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ESMAP

SOLARGIS

ALL EXISTING PLANNED

The Platform ▾

effigis

+

-

Layers

Peak Capacity (MW)

0 – 10

10 – 25

25 – 50

50 – 75

75+

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Questions?



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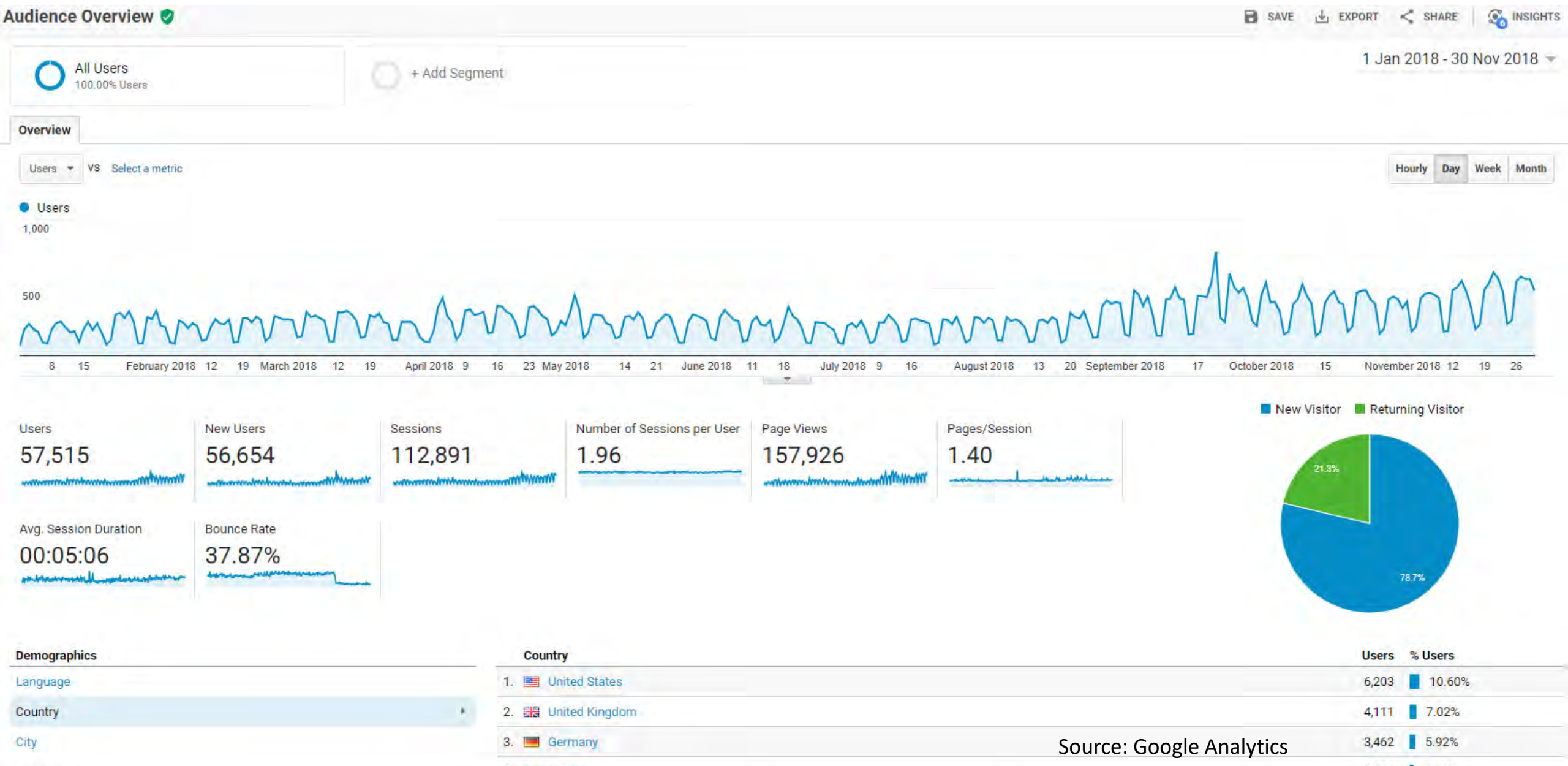
Data Files

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5 5 12

0.000	0.030	0.100	0.400	1.500							
15.0	50.0	80.0	100.0	200.0							
48.92	4.03	3.61	8.20	8.10	2.86	0.58	0.27	0.31	0.21	0.48	26.52
14.53	4.84	5.50	4.70	5.37	5.99	4.44	5.65	6.16	2.59	3.55	16.79
2.631	2.451	3.221	2.338	2.467	2.037	1.287	1.342	1.596	1.002	1.416	3.377
15.88	4.91	5.30	5.13	5.09	5.71	4.32	6.09	5.98	2.30	3.43	18.31
2.752	1.779	2.600	2.311	2.096	1.775	1.186	1.264	1.252	0.830	1.189	3.541
16.98	4.87	4.63	5.27	5.19	5.51	4.24	5.80	7.02	1.69	3.03	19.66
2.889	1.361	1.877	2.252	1.975	1.658	1.096	1.104	1.264	0.666	0.986	3.943
17.55	4.94	3.97	5.24	5.42	5.37	4.35	5.90	7.47	1.69	2.81	20.21
2.920	1.295	1.498	2.186	2.088	1.658	1.131	1.119	1.307	0.646	0.936	3.971
19.25	5.05	2.53	3.25	5.63	5.33	3.29	3.70	7.13	1.46	2.13	19.65
3.029	1.170	1.061	1.205	1.623	1.701	0.982	0.818	1.135	0.588	0.795	3.033
18.39	3.35	4.91	9.05	6.41	1.62	0.38	0.31	0.27	0.23	0.73	56.16
7.89	3.90	4.19	3.55	4.43	3.84	3.94	5.14	3.40	1.83	4.17	12.66
1.529	2.584	2.568	2.072	2.002	1.408	1.221	1.451	1.123	1.002	1.721	3.080
9.60	3.83	4.64	4.21	4.68	4.22	4.29	6.26	4.41	1.86	4.06	14.48
1.709	1.877	2.662	2.244	2.029	1.479	1.221	1.557	1.189	0.877	1.404	3.295
11.17	3.97	4.68	4.77	4.94	4.58	4.34	7.11	4.36	1.88	3.80	15.97
1.932	1.553	2.439	2.322	2.107	1.561	1.201	1.568	1.018	0.807	1.318	3.588
11.97	3.96	4.44	5.09	5.25	4.73	4.30	7.19	4.39	1.70	3.37	16.71
2.057	1.389	2.064	2.396	2.205	1.592	1.182	1.467	0.975	0.756	1.186	3.729
15.51	4.45	3.08	4.75	6.87	5.18	3.96	6.35	5.62	1.49	3.15	18.58
2.510	1.240	1.377	1.639	2.135	1.670	1.115	1.123	1.029	0.697	1.072	3.592
18.39	3.35	4.91	9.05	6.41	1.62	0.38	0.31	0.27	0.23	0.73	56.16
7.09	3.51	3.77	3.19	3.98	3.45	3.54	4.61	3.05	1.64	3.75	11.36
1.525	2.568	2.561	2.064	1.990	1.400	1.213	1.443	1.115	0.994	1.713	3.080

A growing user base



ESMAP Program on RE Mapping

- ESMAP Program
 - Started in 2013, projects in over 15 countries
 - Covers biomass, hydro, solar and wind
 - Includes major solar and wind measurement campaigns
 - https://esmap.org/re_mapping
- Global Solar Atlas and Global Wind Atlas
 - A new 'wholesale' approach
 - Mapping completed for all countries
 - Potential for enhancements and collaboration
- Make measurement data public
 - Public data helps improve the GSA and GWA modeling
 - Must be high quality and documented
 - Hosting platform: <https://energydata.info>