

GLOBAL SOLAR ATLAS

Geo-dáta a online nástroje pre podporu rozvoja solárnej energetiky

Marcel Šúri, Juraj Beták, Tomáš Cebecauer, Michal Moravčík, Šimon Štassel, Konštantín Rosina, Artur Skoczek, Peter Orosi

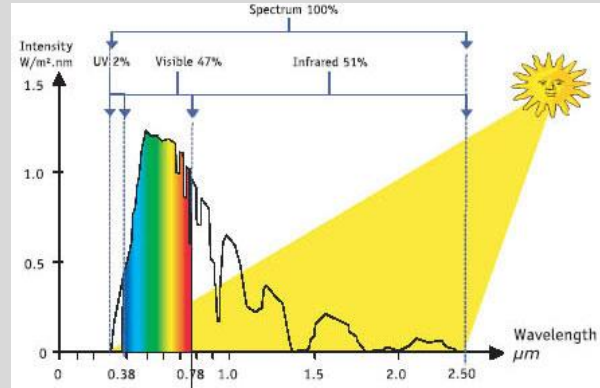
Solargis s.r.o., Mýtna 48, 811 07 Bratislava, contact@solargis.com

O čom budeme hovoriť?

1. Klimatické a meteorologické dáta v kontexte solárnej energetiky
2. Čo nové ponúka **GlobalSolarAtlas.info** verzia 2
3. Vybrané aspekty/funkcionality/implementácie zaujímavé pre GeoKarto komunitu

Solárna radiácia

Viditeľné spektrum

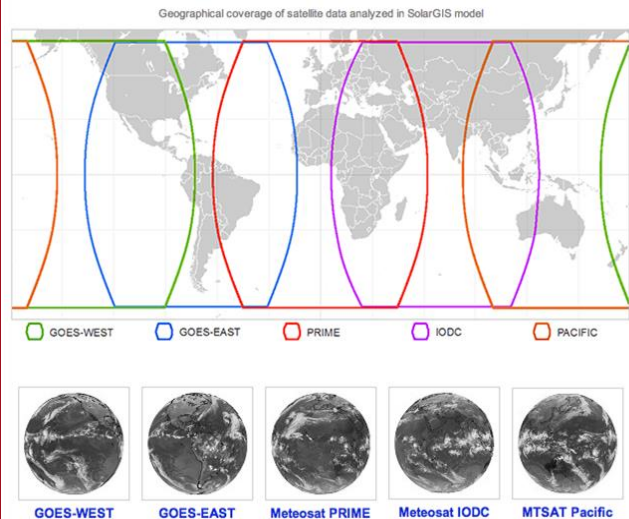


Meranie
VS
Modelovanie

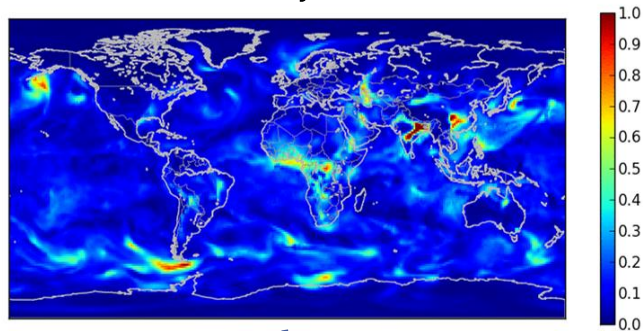


Solargis model

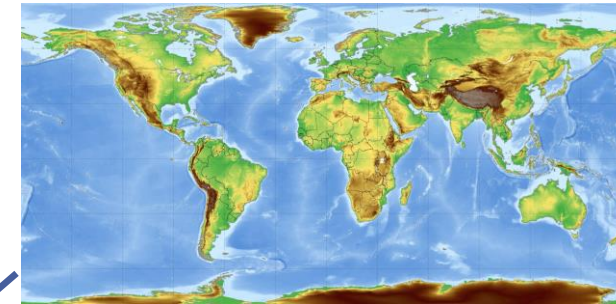
Meteorologické satelity



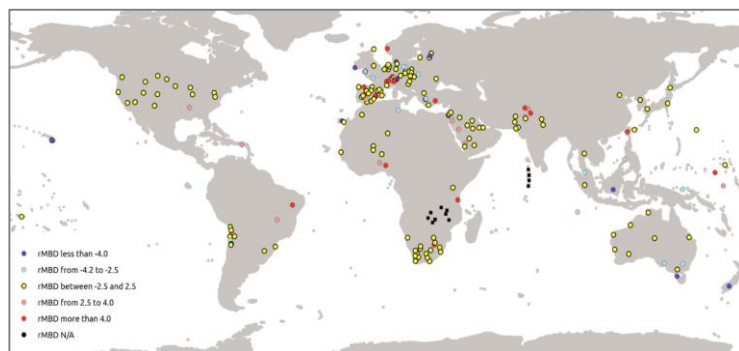
Atmosférické modely



Terén a iné dáta

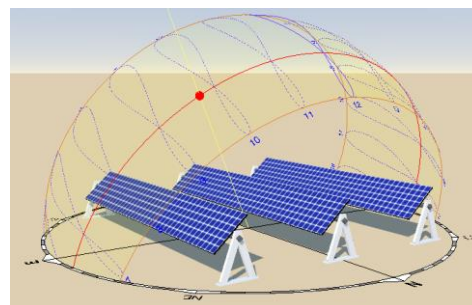


Validácia pomocou solárnych meraní



GeoKarto 2020, 10-11 Sep, Košice

24 / 7 / 10 alebo 15 min časový krok



GHI
DNI
DIF

PVOUT
Výroba elektriny z fotovoltiky



(CSP elektrárne)
DNI: Direct Normal Irradiance
GTI Global Tilted Irradiance (PV elektrárne)



Publikácia dát

solargis.com

Komerčná platforma pre profesionálnych klientov

Bratislava - mestská časť Staré Mesto

Stefánikova, Bratislava - mestská časť Staré Mesto, Region of Bratislava, Slovakia
48.15, 17.1078

MAP DATA	PROJECT DATA
ELE	156 m
PVOUT est	1197 kWh/kWp
GHI	1231 kWh/m ²
DNI	1122 kWh/m ²
DIF	600 kWh/m ²
D2G	0.48
GHI opta	1442 kWh/m ²
OPTA	36 / 180
GHI season	7.7
DNI season	4.1
ALB	0.14
TEMP	11.1 °C
WS	4.0 m/s
RH	74 %
PWAT	17 kg/m ²

Summary

- Specific potential power output: 1488
- All-weather hourly average: 10.3
- Specific potential power output (incl. losses): 1204
- Performance ratio hourly average: 80.5%

Project Info

Project name: Bratislava
Address: Bratislava, Slovakia
Region: Bratislava, Slovakia
Coordinates: 48.15, 17.1078

PV system configuration

System type: Ground-based fixed-tilt
PV module type: Monocrystalline silicon (PERC)
PV module efficiency: 20.5%
PV module area: 1000 m²
PV system capacity: 1000 kWp

Parameter	Value
Specific potential power output	1488
All-weather hourly average	10.3
Specific potential power output (incl. losses)	1204
Performance ratio hourly average	80.5%
Specific potential power output (incl. losses) (PERC)	1204
Performance ratio hourly average (PERC)	80.5%
Specific potential power output (incl. losses) (PERC) (incl. losses)	1197
Performance ratio hourly average (PERC) (incl. losses)	80.5%

PV electricity - Hourly profile

Summary

- Hourly electricity production (kWh/kWp): 1.0
- Hourly electricity production (kWh/kWp) (incl. losses): 0.9
- Hourly electricity production (kWh/kWp) (incl. losses) (PERC): 0.9

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hourly electricity production (kWh/kWp)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Hourly electricity production (kWh/kWp) (incl. losses)	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Hourly electricity production (kWh/kWp) (incl. losses) (PERC)	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9

Products

- Prospect**: Solar prospecting tool for fast and reliable project site feasibility.
- Time series and TMY data**: For advanced energy modelling and design optimisation of solar power plants.
- Monitor**: Receive regular updates of Solargis data for performance monitoring of production systems.
- Forecast**: Solar power forecast for up to 10 days ahead.
- API**: Integrate Solargis data into your applications, effectively require data for a large number of projects.

Consultancy services

- Solar resource assessment study**: Validation and analysis of solar resource and meteorological conditions at a project site, documented in a bankable report.
- PV energy yield assessment study**: Independent energy yield assessment study with detailed analysis of the energy simulation steps and related uncertainties.
- PV performance assessment study**: Obtain a verified and more accurate estimate of long-term energy yield. Additionally, identify underperformance and take corrective measures to maximise energy yield.
- Quality control of solar radiation measurements**: Independent validation and quality control of solar and meteorological measurements.
- Site-adaptation of Solargis data**: Use of ground-based solar resource measurements to improve accuracy of Solargis data for your project site.
- Regional solar energy potential study**: Comprehensive knowledge base in the form of GIS data, maps, and expert reports that provides strategic information on solar potential of a region.
- PV variability and grid integration study**: To help transmission planners and researchers understand variability in solar power production for hypothetical case penetration scenarios.

Not sure which product or service is right for you?

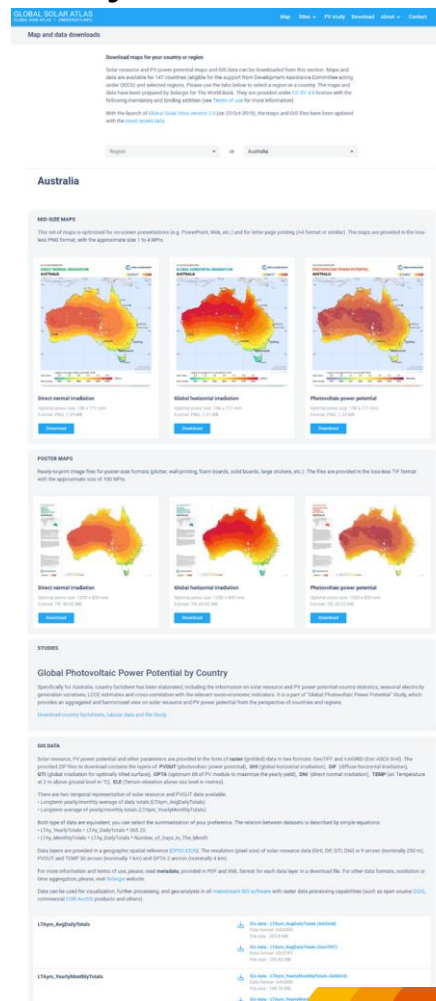
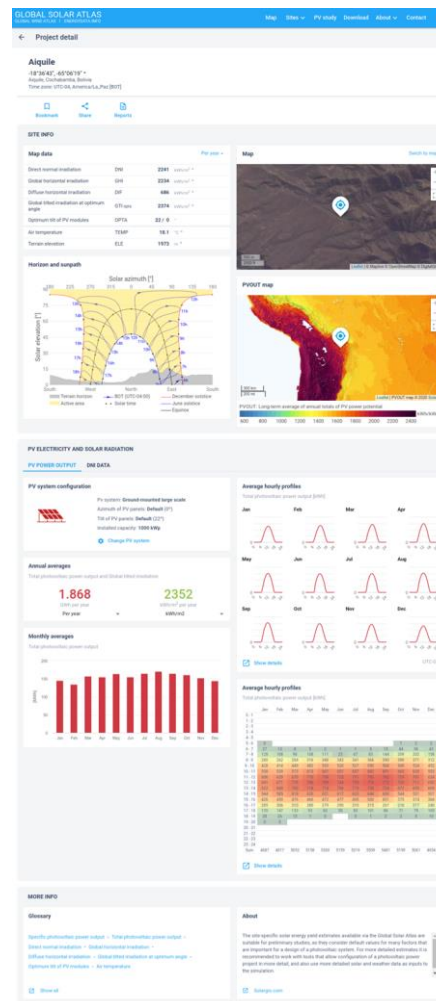
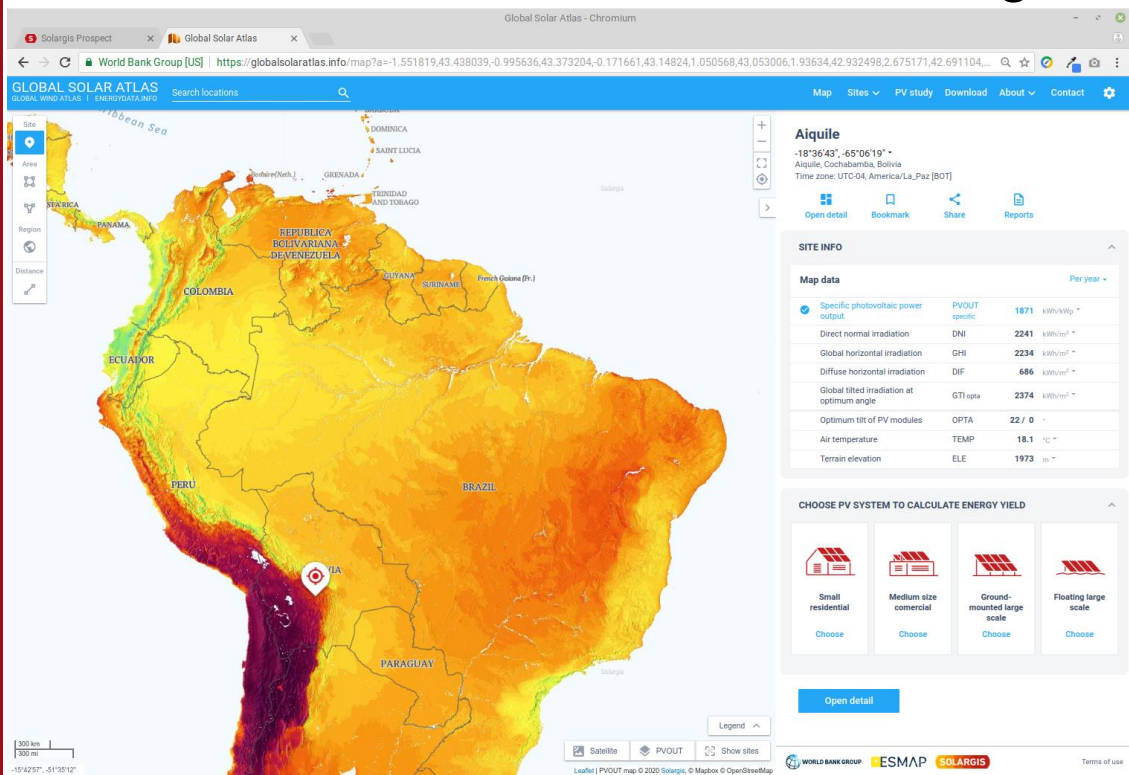
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Publikácia dát

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Global Solar Atlas is provided by the World Bank Group, financed by ESMAP and created by Solargis



Global Solar Atlas





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Verzia 1

- Publikácia v roku 2017 (prezentácia GeoKarto 2018)

Verzia 2

- Publikácia 2019/2020
- Update klimatických dát (časový rad o +3 roky)
- Architektúra aplikácia na AWS (v spolupráci s [ableneo.com](#) )
- Nový koncept UI (v spolupráci s [001studio](#) )
- Nové funkcionality
- Dokumentácia a štúdijný materiál

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GLOBAL WIND ATLAS | ENERGYDATA.INFO

Search locations

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Site Area Region Distance

North Atlantic Ocean

EUROPE ASIA

AFRICA SOUTH AMERICA

Arabian Sea Indian Ocean

South Atlantic Ocean

Legend

2400
2300
2200
2100
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
kWh/kWp

1000 km
1000 mi

56°56'42", 08°15'42"

Satellite PVOUT Show sites

Leaflet | PVOUT map © 2020 Solargis, © Mapbox © OpenStreetMap

Merta

26°25'52", 74°10'47"
Merta, Rajasthan, India
Time zone: UTC+05:30, Asia/Kolkata [IST]

Open detail Bookmark Share Reports

SITE INFO

Map data Per year

Specific photovoltaic power output	PVOUT specific	1720 kWh/kWp
Direct normal irradiation	DNI	1739 kWh/m ²
Global horizontal irradiation	GHI	1993 kWh/m ²
Diffuse horizontal irradiation	DIF	851 kWh/m ²
Global tilted irradiation at optimum angle	GTI opta	2224 kWh/m ²
Optimum tilt of PV modules	OPTA	30 / 180 °
Air temperature	TEMP	26.1 °C
Terrain elevation	ELE	343 m

CHOOSE PV SYSTEM TO CALCULATE ENERGY YIELD

Small residential Medium size comercial Ground-mounted large scale Floating large scale

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Search locations

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Site
Area
Region
Distance

POLAND
CZECH REPUBLIC
AUSTRIA
HUNGARY
SLOVENIA
CROATIA
BOSNIA AND HERZEGOVINA
SERBIA
SAN MARINO
MONTENEGRO
ALBANIA
GREECE

Prague
Vienna
Bratislava

Select a map layer

- Topographic
- Satellite
- Specific photovoltaic power output
- Global horizontal irradiation
- Direct normal irradiation
- Global tilted irradiation at optimum angle
- Optimum tilt of PV modules
- Air temperature
- Elevation

Labels

Merta
26°25'52", 74°10'47"
India
05:30, Asia/Kolkata [IST]

Bookmark Share Reports

Per year

Photovoltaic power	PVOUT specific	1720 kWh/kWp
Global irradiation	DNI	1739 kWh/m ²
Global horizontal irradiation	GHI	1993 kWh/m ²
Global horizontal irradiation	DIF	851 kWh/m ²
Global irradiation at angle	GTI opta	2224 kWh/m ²
Optimum tilt of PV modules	OPTA	30 / 180
Air temperature	TEMP	26.1 °C
Elevation	ELE	343 m

SYSTEM TO CALCULATE ENERGY YIELD

- Small residential
- Medium size comercial
- Ground-mounted large scale
- Floating large scale

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Direct normal irradiation	DNI	1212 kWh/m ²
Global horizontal irradiation	GHI	1697 kWh/m ²
Diffuse horizontal irradiation	DIF	896 kWh/m ²
Global tilted irradiation at optimum angle	GTI _{opta}	1871 kWh/m ²
Optimum tilt of PV modules	OPTA	28 / 180 °
Air temperature	TEMP	23.1 °C
Terrain elevation	ELE	250 m

PV SYSTEM DATA

PV system configuration

Pv system: **Ground-mounted large scale**
Azimuth of PV panels: **Default (180°)**
Tilt of PV panels: **Default (28°)**
Installed capacity: **1000 kWp**

[Change PV system](#)

Annual averages

Total photovoltaic power output and Global tilted irradiation

1.461 GWh per year Per year	1848 kWh/m ² per year kWh/m ²
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[Open detail](#)

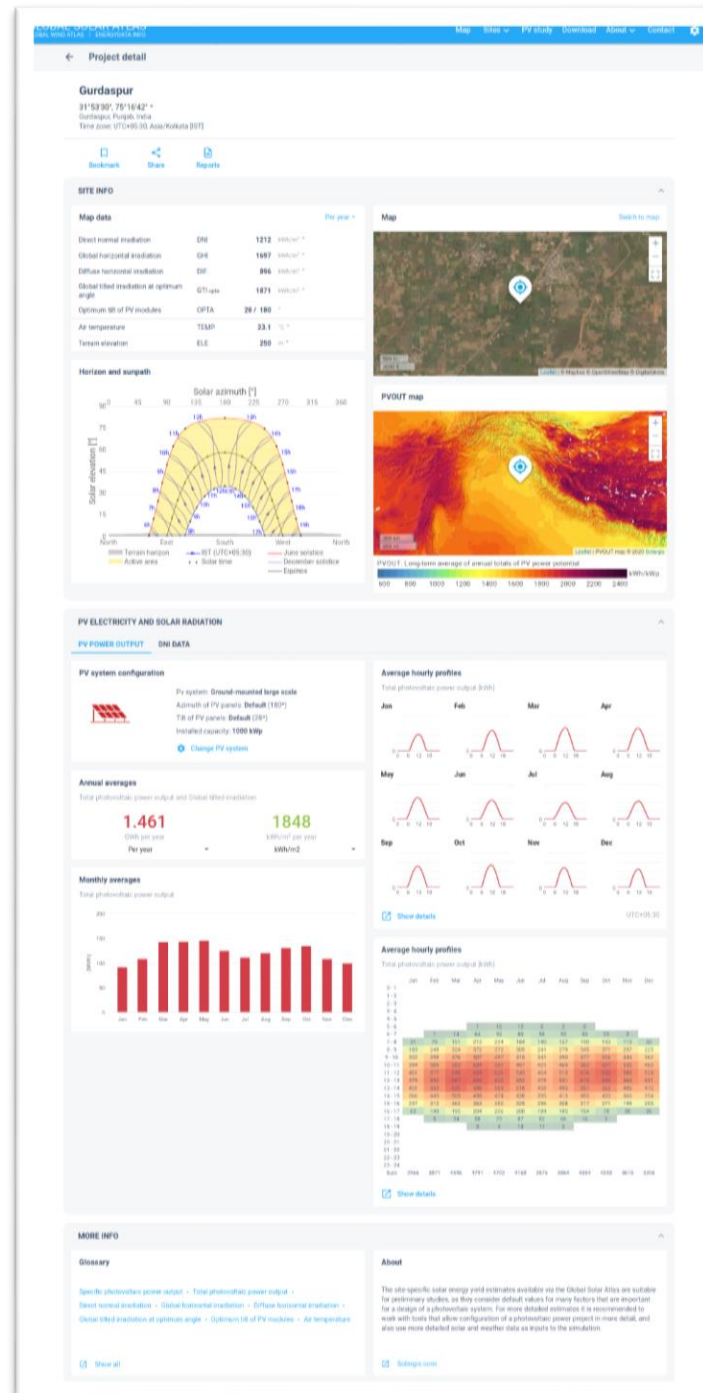
Legend: 3700, 3400, 3100, 2800, 2500, 2200, 1900, 1600, 1300, 1000, 700, 400 kWh/m²

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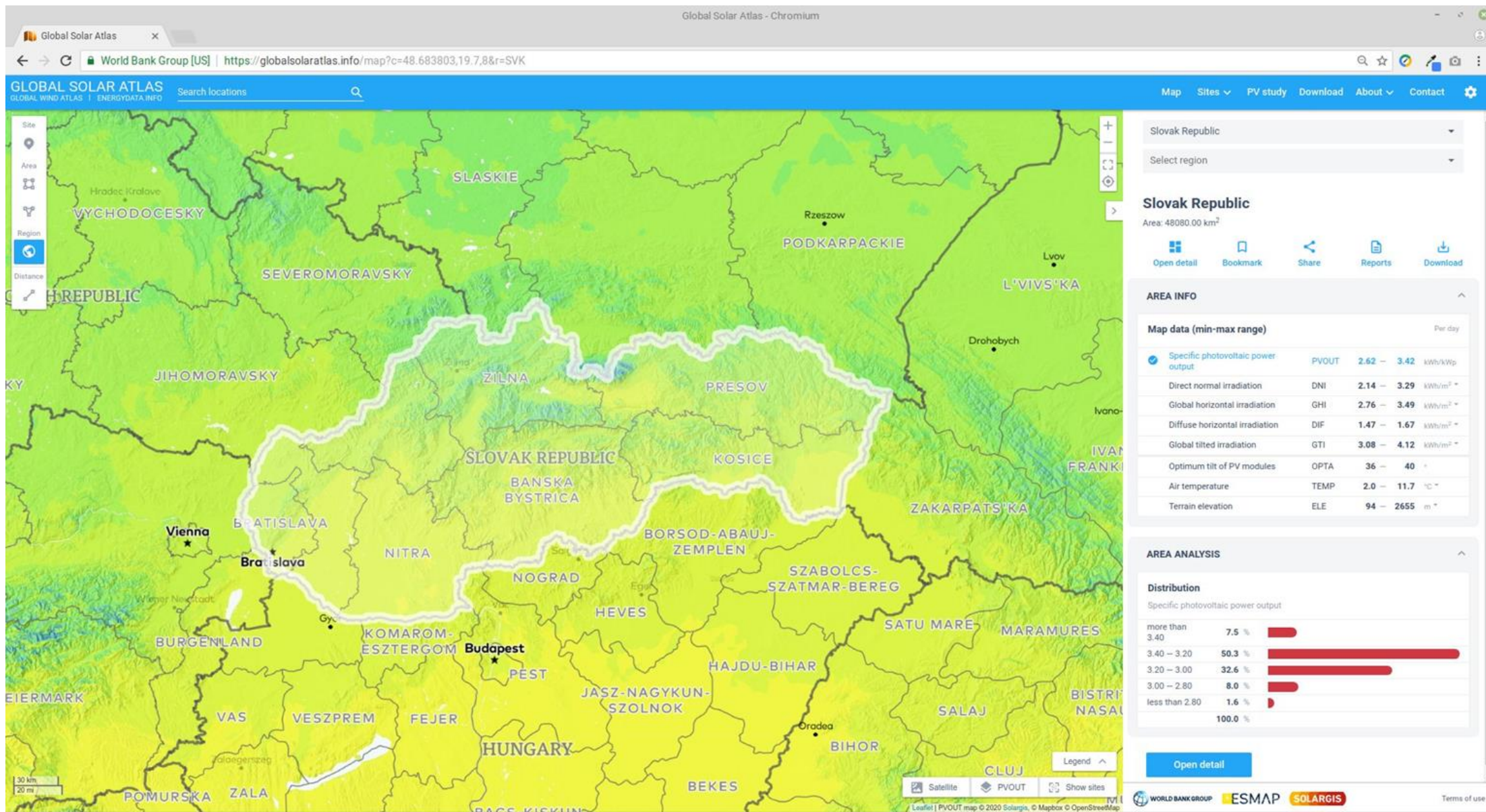


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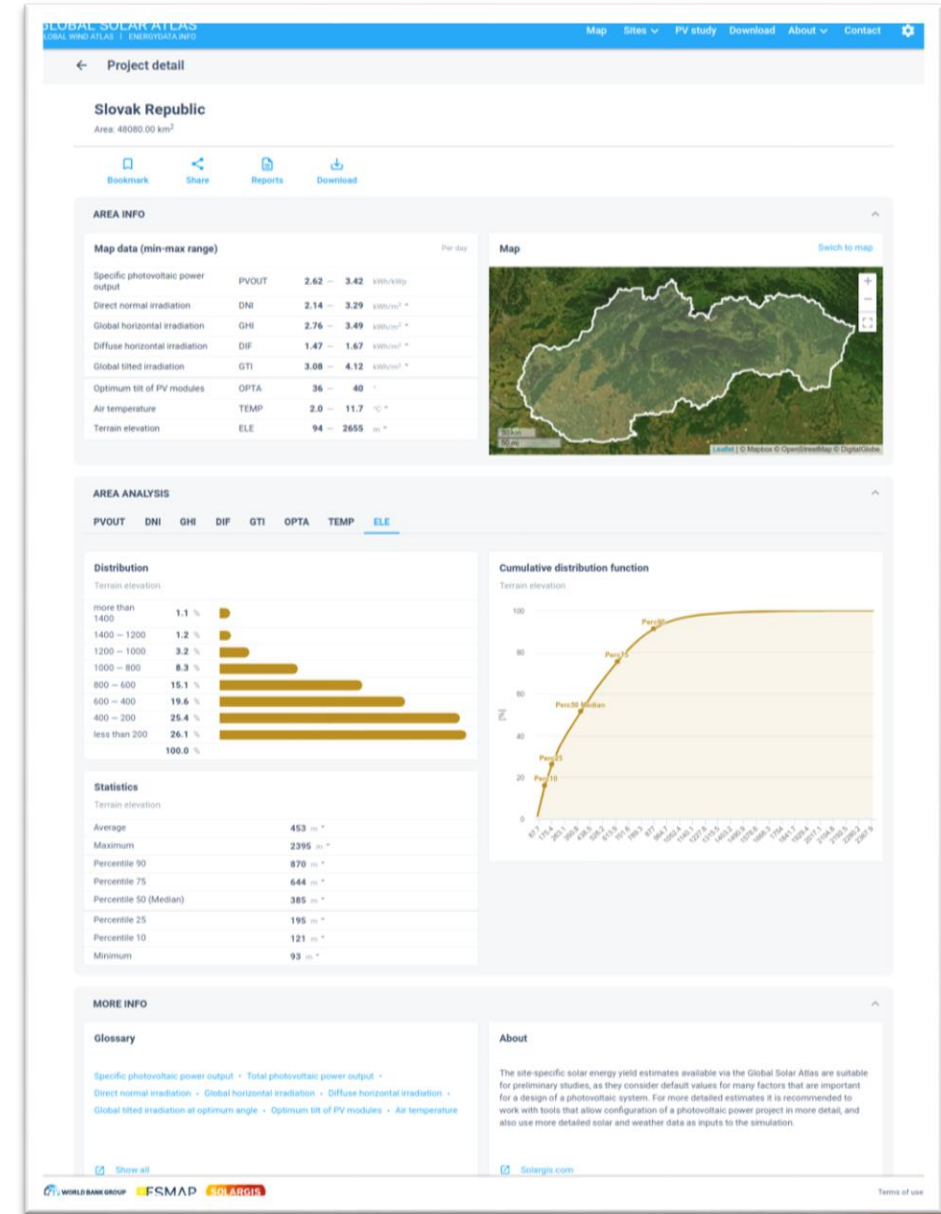
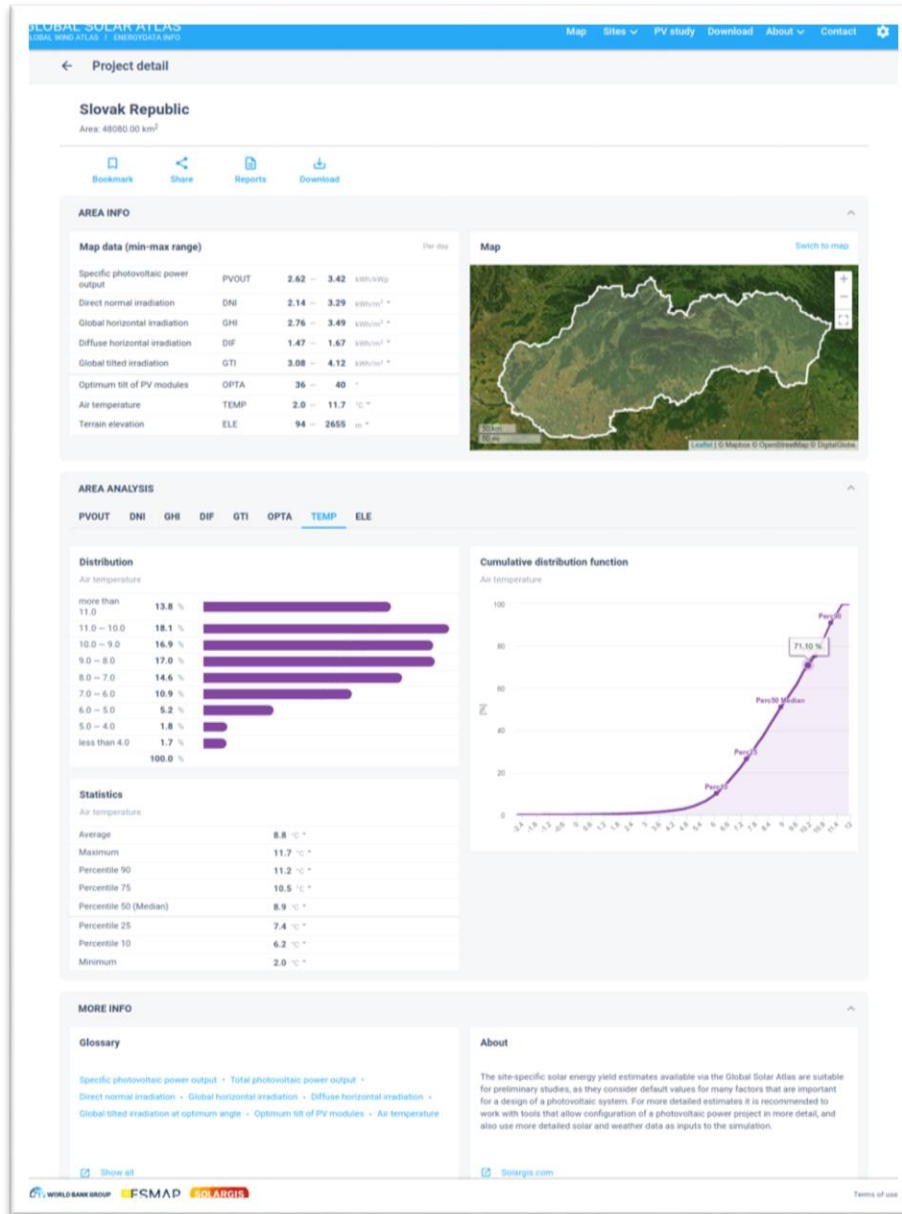
- Report – PDF format
- Data – XLSX format

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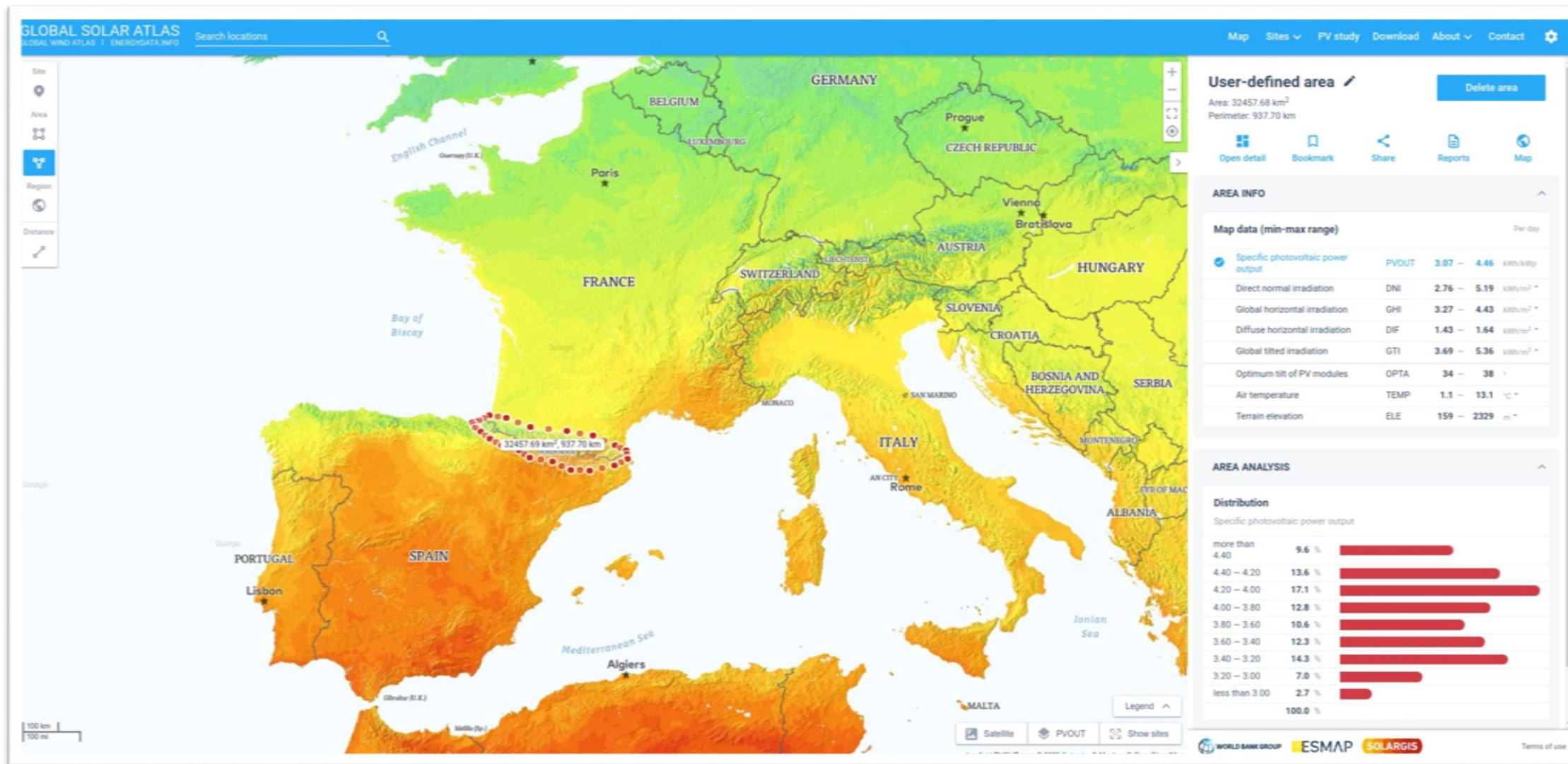
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Project detail

Pyrenees
Area: 32457.68 km²
Perimeter: 937.70 km

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AREA INFO

Map data (min-max range) Per day

Specific photovoltaic power output	PVOUT	3.07 – 4.46	kWh/kWp
Direct normal irradiation	DNI	2.76 – 5.19	kWh/m ²
Global horizontal irradiation	GHI	3.27 – 4.43	kWh/m ²
Diffuse horizontal irradiation	DIF	1.43 – 1.64	kWh/m ²
Global tilted irradiation	GTI	3.69 – 5.36	kWh/m ²
Optimum tilt of PV modules	OPTA	34 – 38	°
Air temperature	TEMP	1.1 – 13.1	°C
Terrain elevation	ELE	159 – 2329	m

Map

AREA ANALYSIS

PVOUT DNI GHI DIF GTI OPTA TEMP ELE

Distribution
Specific photovoltaic power output

more than 4.40	9.6 %
4.40 – 4.20	13.6 %
4.20 – 4.00	17.1 %
4.00 – 3.80	12.8 %
3.80 – 3.60	10.6 %
3.60 – 3.40	12.3 %
3.40 – 3.20	14.3 %
3.20 – 3.00	7.0 %
less than 3.00	2.7 %
100.0 %	

Statistics
Specific photovoltaic power output

Average	3.81	kWh/kWp
Maximum	4.46	kWh/kWp
Percentile 90	4.38	kWh/kWp
Percentile 75	4.16	kWh/kWp
Percentile 50 (Median)	3.84	kWh/kWp
Percentile 25	3.39	kWh/kWp
Percentile 10	3.19	kWh/kWp
Minimum	3.07	kWh/kWp

Cumulative distribution function
Specific photovoltaic power output

MORE INFO

Glossary

Specific photovoltaic power output • Total photovoltaic power output • Direct normal irradiation • Global horizontal irradiation • Diffuse horizontal irradiation • Global tilted irradiation at optimum angle • Optimum tilt of PV modules • Air temperature

About

The site-specific solar energy yield estimates available via the Global Solar Atlas are suitable for preliminary studies, as they consider default values for many factors that are important for a design of a photovoltaic system. For more detailed estimates it is recommended to work with tools that allow configuration of a photovoltaic power project in more detail, and also use more detailed solar and weather data as inputs to the simulation.

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PVOUT DNI GHI DIF GTI OPTA TEMP ELE

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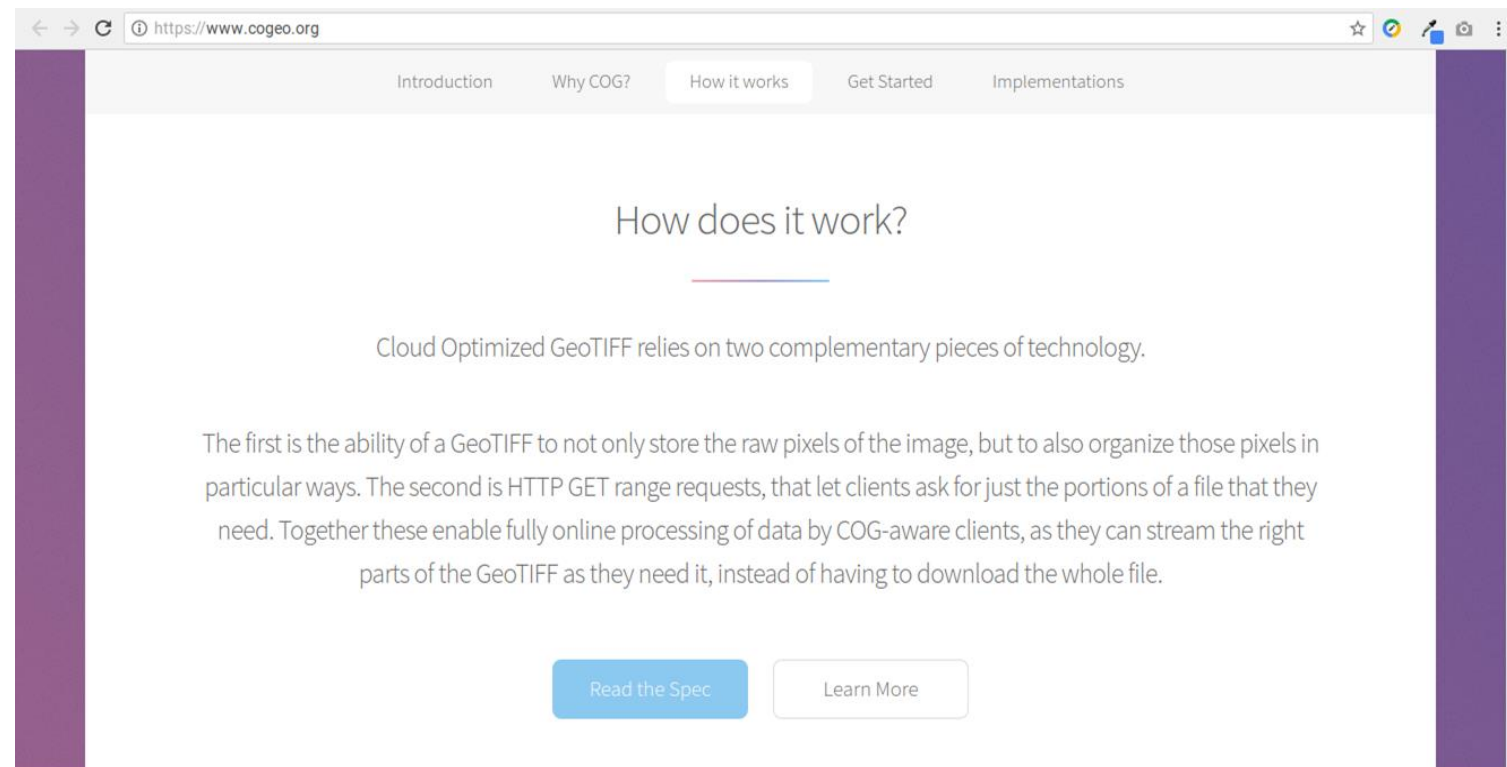
COG: Cloud Optimized GeoTIFF

= malá revolúcia pre prácu s veľkými rastrovými dátami

Vývoj OSGeo Foundation/GDAL, začiatok ~2016

Projekt + doku: <https://github.com/cogeotiff/> (3 contributors)

<https://www.cogeo.org/>



→ August 2020, Bratislava
Peter Piesecky,
Milo Ofukany, a kol.

Mapy pre 180+ krajín/regiónov

Formát A0 (poster) a A4,
Renderované v **QGIS**



Preklady pre vybrané krajiny (~60)
FR, ES, PT, RU, CN, KO, TR

Využitie:

Prezentácie, reporty, strategické stretnutia
učebnice, wikipedia, atď.

Australia

MID-SIZE MAPS
This set of maps is optimized for on-screen presentations (e.g. PowerPoint, Web, etc.) and for letter page printing (A4 format or similar). The maps are provided in the loss-less PNG format, with the approximate size 1 to 4 MPix.

SOLAR RESOURCE MAP
DIRECT NORMAL IRRADIATION
AUSTRALIA

Optimal press size: 156 x 171 mm
Format: PNG, 1.29 MB

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SOLAR RESOURCE MAP
GLOBAL HORIZONTAL IRRADIATION
AUSTRALIA

Optimal press size: 156 x 171 mm
Format: PNG, 1.31 MB

[Download](#)

SOLAR RESOURCE MAP
PHOTOVOLTAIC POWER POTENTIAL
AUSTRALIA

Optimal press size: 156 x 171 mm
Format: PNG, 1.33 MB

[Download](#)

POSTER MAPS
Ready-to-print image files for poster-size formats (plotter, wall-printing, foam boards, solid boards, large stickers, etc.). The files are provided in the loss-less TIF format with the approximate size of 100 MPix.

SOLAR RESOURCE MAP
DIRECT NORMAL IRRADIATION
AUSTRALIA

Optimal press size: 1200 x 800 mm
Format: TIF, 58.02 MB

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SOLAR RESOURCE MAP
GLOBAL HORIZONTAL IRRADIATION
AUSTRALIA

Optimal press size: 1200 x 800 mm
Format: TIF, 60.82 MB

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SOLAR RESOURCE MAP
PHOTOVOLTAIC POWER POTENTIAL
AUSTRALIA

Optimal press size: 1200 x 800 mm
Format: TIF, 35.53 MB

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GIS data pre 180+ krajín/regiónov

Rastrový formát:

GeoTIFF

ESRI ASCII GRID

Google Scholar 2019:

~ 200 štúdií

Štúdie, *Fact-sheets* →

STUDIES

Global Photovoltaic Power Potential by Country

Specifically for Australia, country factsheet has been elaborated, including the information on solar resource and PV power potential country statistics, seasonal electricity generation variations, LCOE estimates and cross-correlation with the relevant socio-economic indicators. It is a part of "Global Photovoltaic Power Potential" Study, which provides an aggregated and harmonized view on solar resource and PV power potential from the perspective of countries and regions.

[Download country factsheets, tabular data and the Study](#)

GIS DATA

Solar resource, PV power potential and other parameters are provided in the form of **raster** (gridded) data in two formats: GeoTIFF and AAIGRID (Esri ASCII Grid). The provided ZIP files to download contains the layers of: **PVOUT** (photovoltaic power potential), **GHI** (global horizontal irradiation), **DIF** (diffuse horizontal irradiation), **GTI** (global irradiation for optimally tilted surface), **OPTA** (optimum tilt of PV module to maximize the yearly yield), **DNI** (direct normal irradiation), **TEMP** (air Temperature at 2 m above ground level in °C), **ELE** (Terrain elevation above sea level in metres).

There are two temporal representation of solar resource and PVOUT data available:

- Longterm yearly/monthly average of daily totals (LT_Aym_AvgDailyTotals)
- Longterm average of yearly/monthly totals (LT_Aym_YearlyMonthlyTotals)

Both type of data are equivalent, you can select the summarization of your preference. The relation between datasets is described by simple equations:

- $LT_Ay_YearlyTotals = LT_Ay_DailyTotals * 365.25$
- $LT_Ay_MonthlyTotals = LT_Ay_DailyTotals * Number_of_Days_in_The_Month$

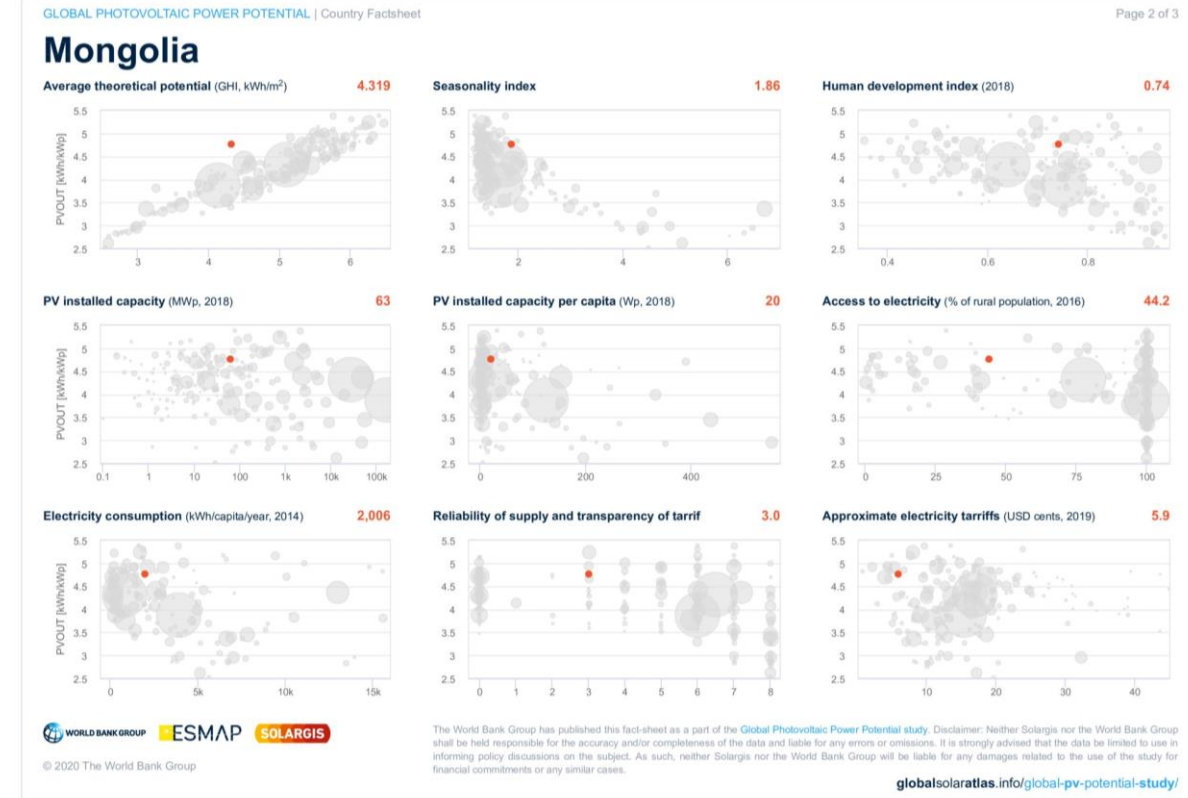
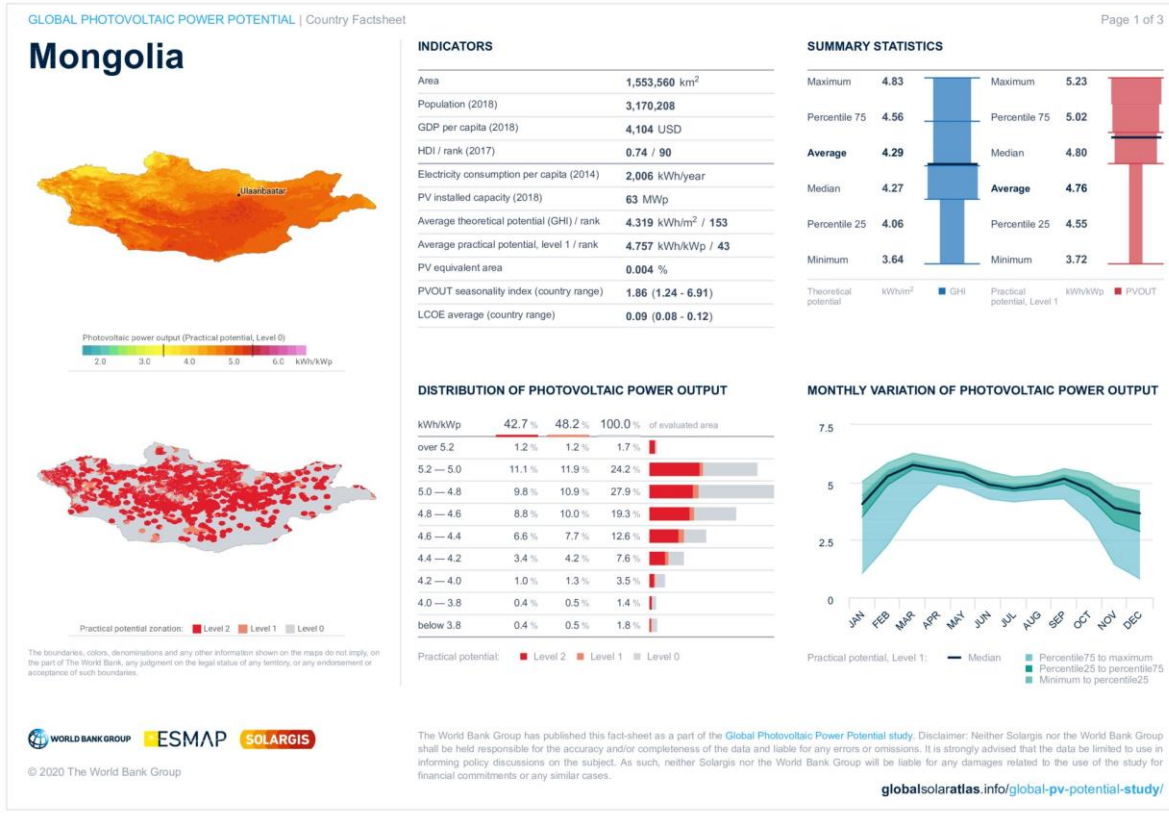
Data layers are provided in a geographic spatial reference (EPSG:4326). The resolution (pixel size) of solar resource data (GHI, DIF, GTI, DNI) is 9 arcsec (nominally 250 m), PVOUT and TEMP 30 arcsec (nominally 1 km) and OPTA 2 arcmin (nominally 4 km).

For more information and terms of use, please, read **metadata**, provided in PDF and XML format for each data layer in a download file. For other data formats, resolution or time aggregation, please, visit [Solargis](#) website.

Data can be used for visualization, further processing, and geo-analysis in all **mainstream GIS software** with raster data processing capabilities (such as open source QGIS, commercial ESRI ArcGIS products and others).

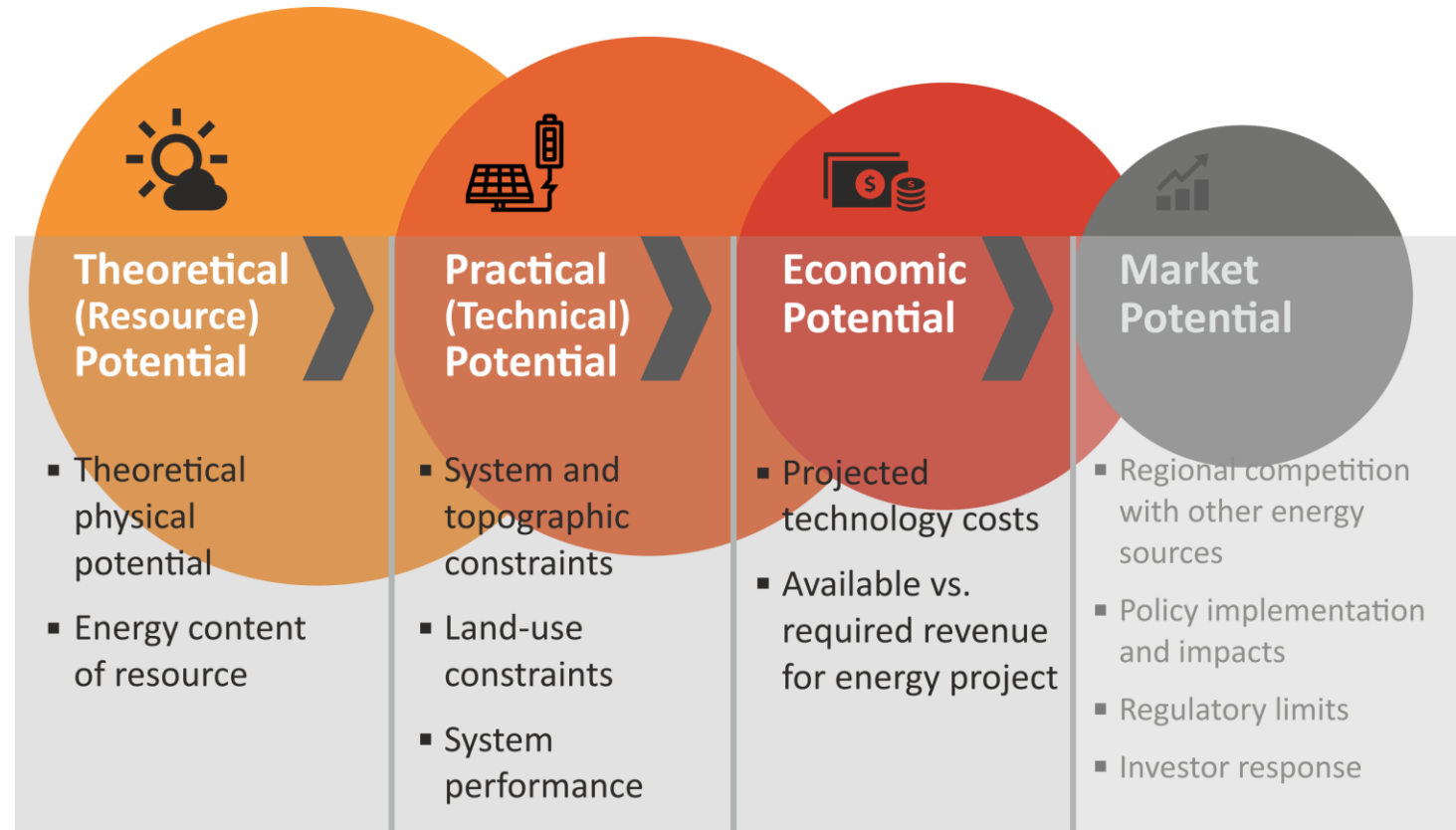
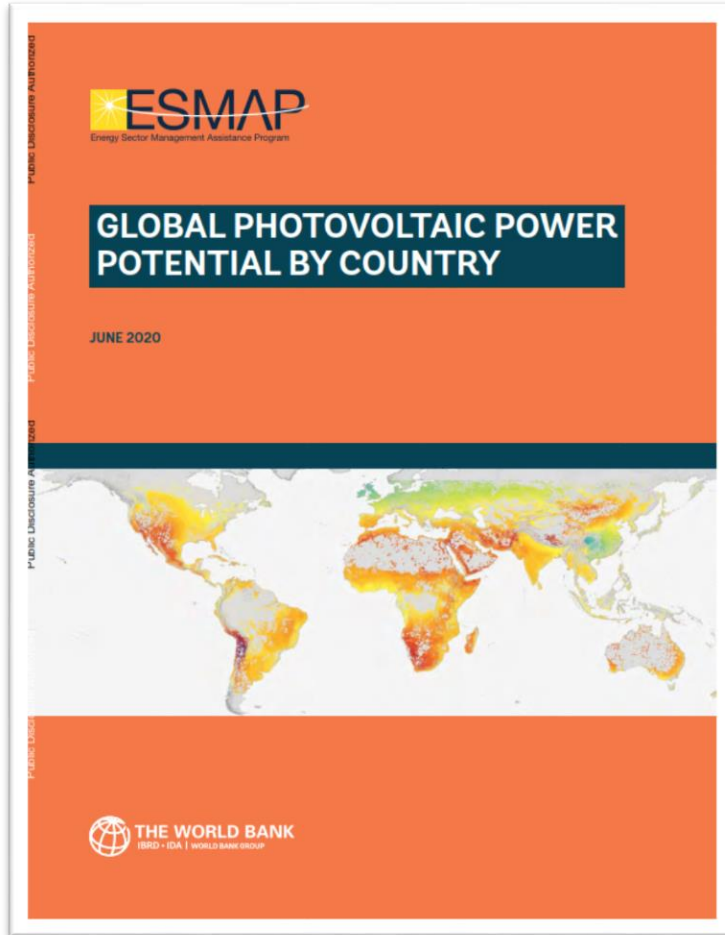
LT_Aym_AvgDailyTotals	↓ Gis data - LT_Aym_AvgDailyTotals (AAIGRID) Data format: AAIGRID File size : 203.8 MB
	↓ Gis data - LT_Aym_AvgDailyTotals (GeoTIFF) Data format: GeoTIFF File size : 725.82 MB
LT_Aym_YearlyMonthlyTotals	↓ Gis data - LT_Aym_YearlyMonthlyTotals (AAIGRID) Data format: AAIGRID File size : 148.76 MB
	↓ Gis data - LT_Aym_YearlyMonthlyTotals (GeoTIFF) Data format: GeoTIFF File size : 755.16 MB

Štúdie, Fact-sheets →



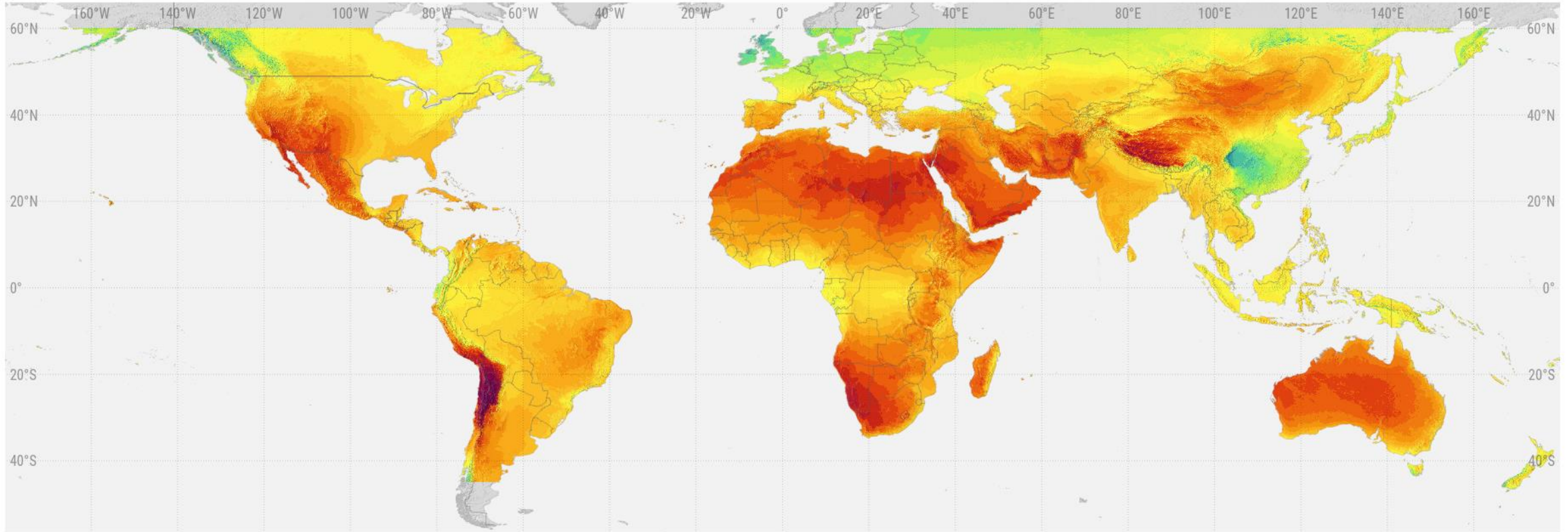
Global Photovoltaic Power Potential By Country

ESMAP, 2020. Washington, DC: World Bank.



<https://documents.worldbank.org/en/publication/documents-reports/documentdetail/466331592817725242/global-photovoltaic-power-potential-by-country>

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Long-term average of PVOUT

Daily totals:

1.8 2.2 2.6 3.0 3.4 3.8 4.2 4.6 5.0 5.4 5.8 6.2



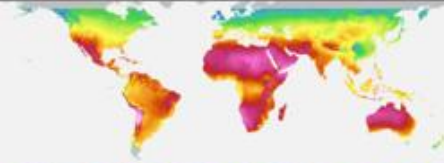
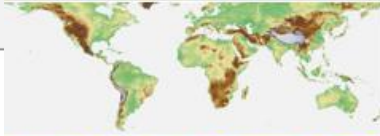
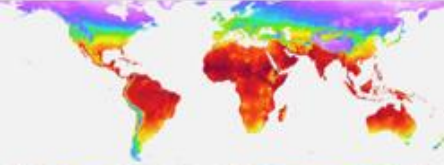

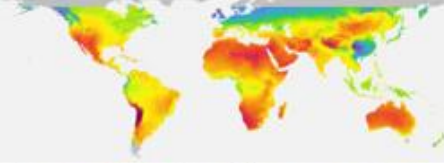









kWh/kWp

Yearly totals:

657 803 949 1095 1241 1387 1534 1680 1826 1972 2118 2264

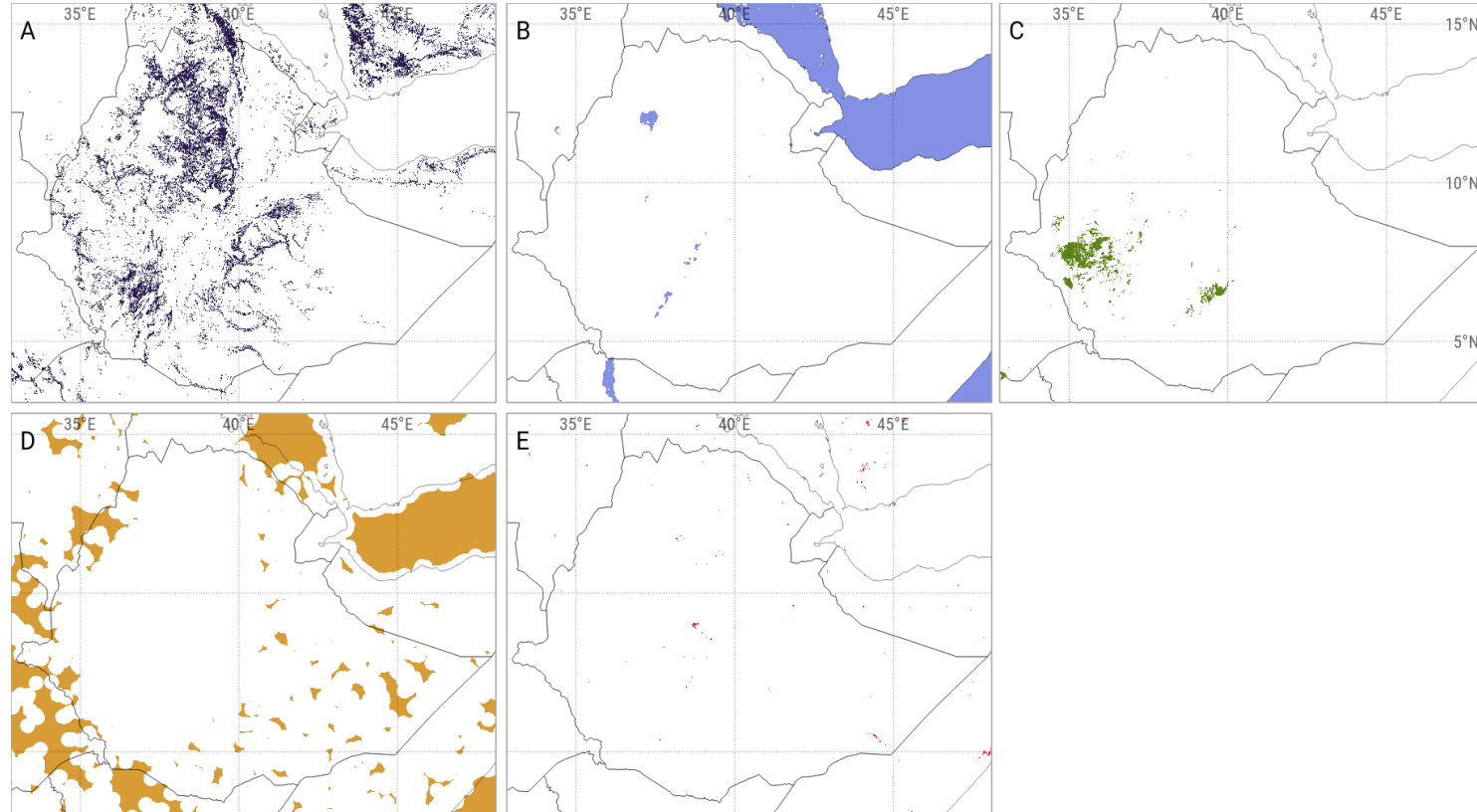
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MCDA – Multiple criteria decision analysis

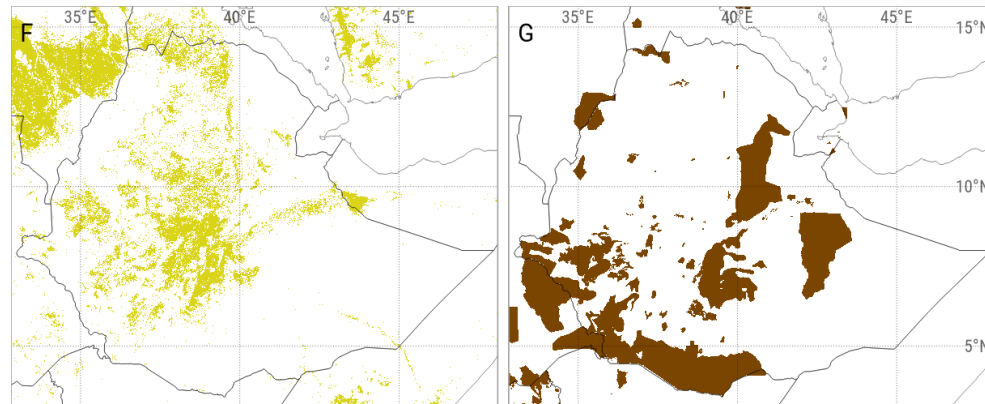
Preview	Name	Source	Spatial resolution ¹				
	Global horizontal irradiance (GHI)	Solargis	30 arcsec (approx. 1 km)		Terrain elevation	Merged data sources, post-processed by Solargis. SRTMv4.1 (Jarvis, et al, 2008), viewfinderpanoramas.org by Jonathan de Ferranti, ASTER GDEM v2 (ASTER Science Team, 2009)	3 arcsec (approx. 90 m)
	Air temperature at 2 meters (TEMP)	ECMWF, NASA and Solargis	30 arcsec (approx. 1 km)		Terrain slope	Derived from terrain elevation by Solargis	3 arcsec (approx. 90 m)
	Photovoltaic power potential (PVOU)	Solargis	30 arcsec (approx. 1 km)		Built-up area density	GHS BUILT-UP, EC JRC (Pesaresi, et al, 2015)	1 km
	PVOU seasonality index (PVOU _{SEASON})	Solargis	30 arcsec (approx. 1 km)		Population clusters	GHS S-MOD, EC JRC (Pesaresi, et al, 2016)	1 km
	Levelized cost of electricity (LCOE)	Solargis, based on inputs from IRENA [17]	30 arcsec (approx. 1 km)		Tree cover density	MOD44B Version 6 Vegetation Continuous Fields (Dimiceli, et al, 2015)	250 m
	Administrative boundaries	Cartography Unit, GSDPM, World Bank Group, 2016.	Vector polygon layer		Land cover	Land Cover CCI, v2.0.7 © ESA Climate Change Initiative - Land Cover led by UCLouvain (2017)	10 arcsec (approx. 330 m)
					Water bodies	Global Surface Water, Source: Source: EC JRC/Google (Pekele, et al, 2016)	1 arcsec (approx. 30 m)
					Protected areas	World Database on Protected Areas (UNEP-WCMC, 2016)	Vector polygon layer

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LEVEL 1

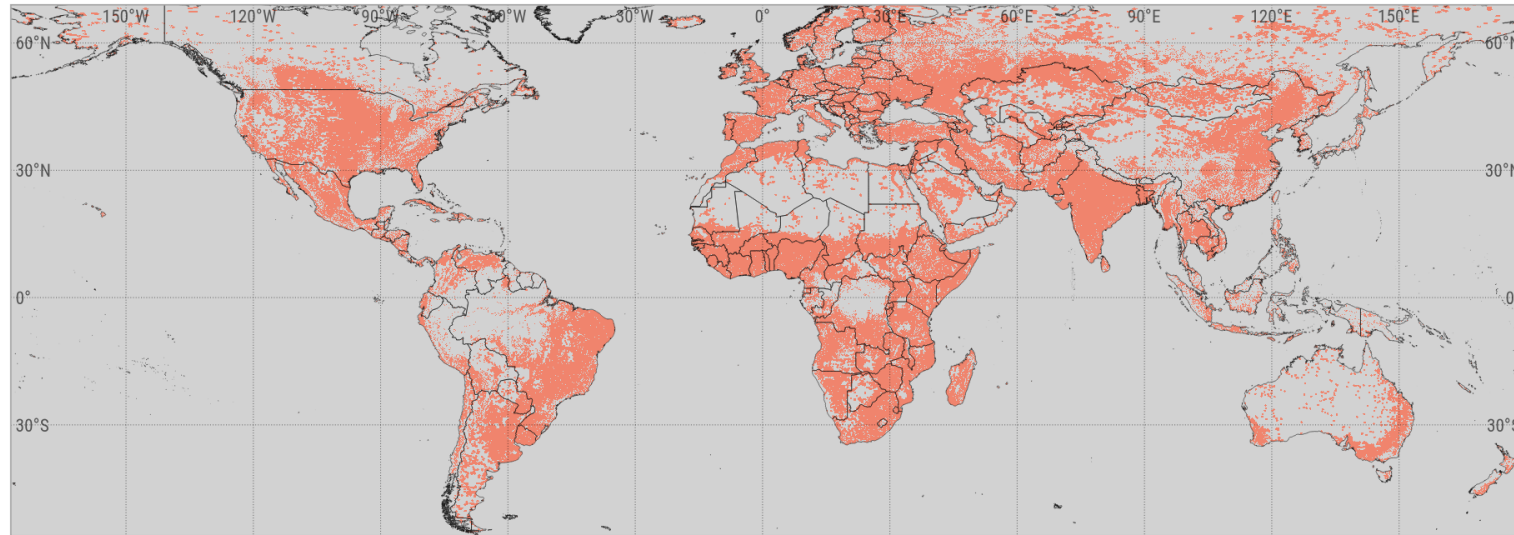


LEVEL 2



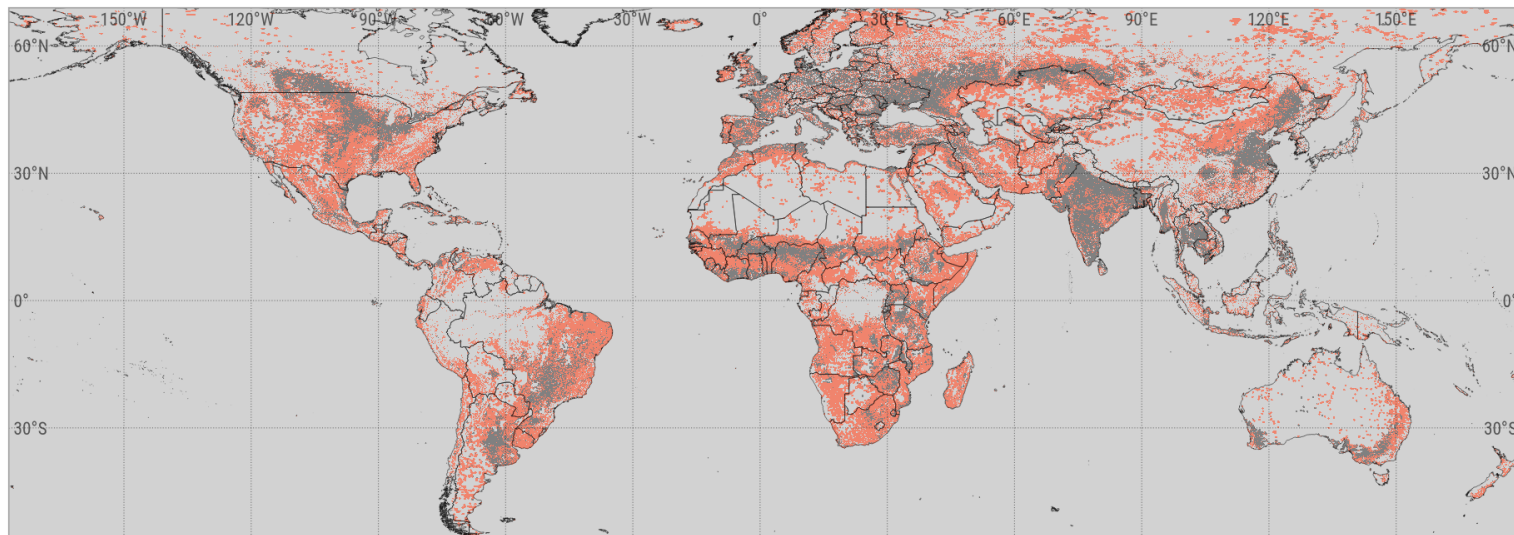
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LEVEL 1



■ A ■ B

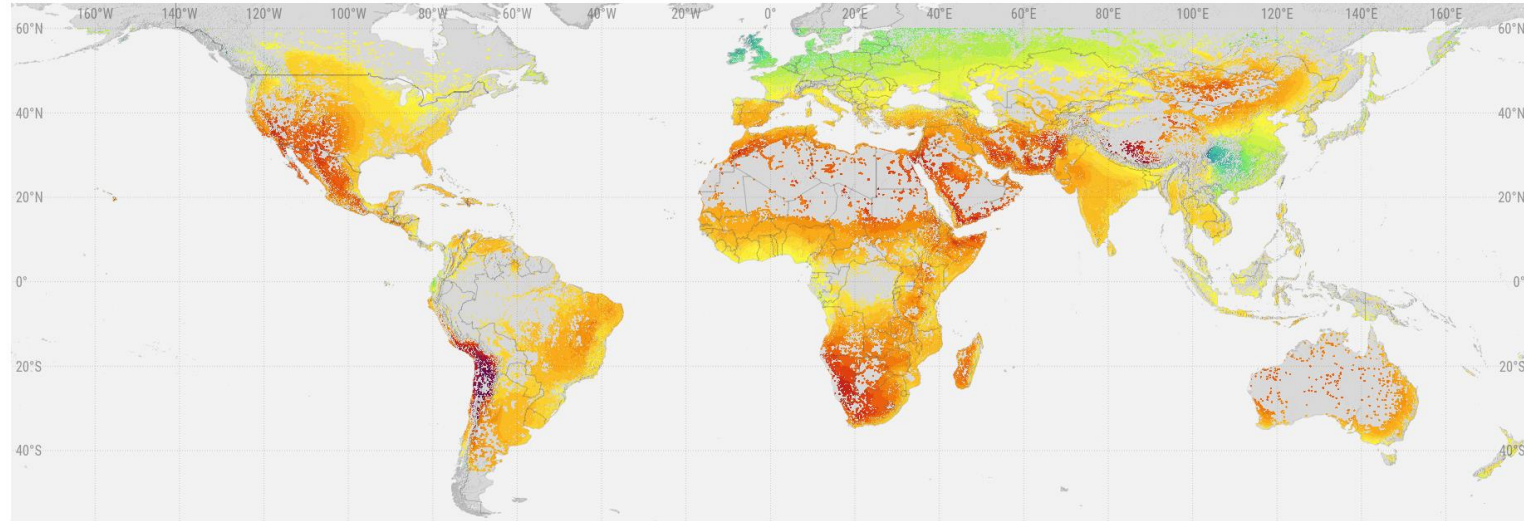
LEVEL 2



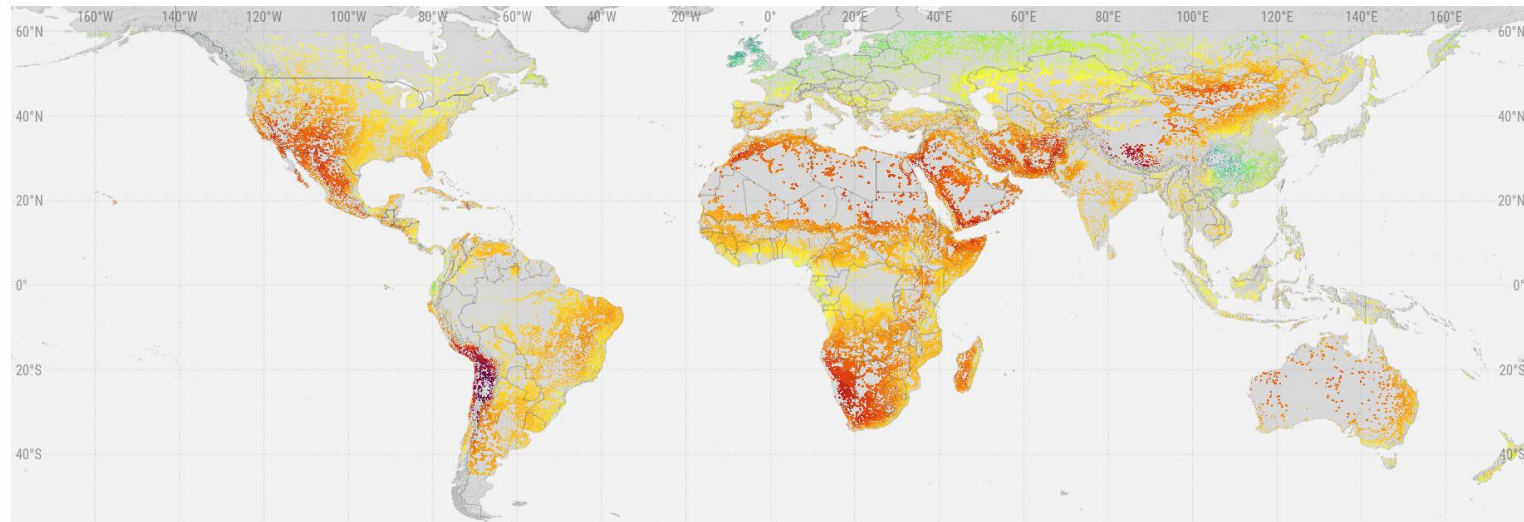
■ A ■ B ■ C

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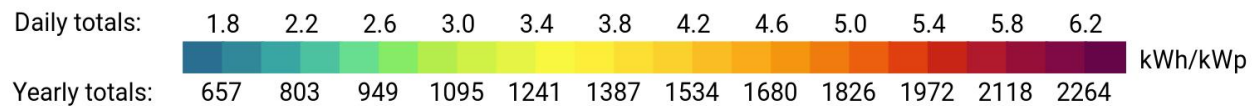
LEVEL 1



LEVEL 2



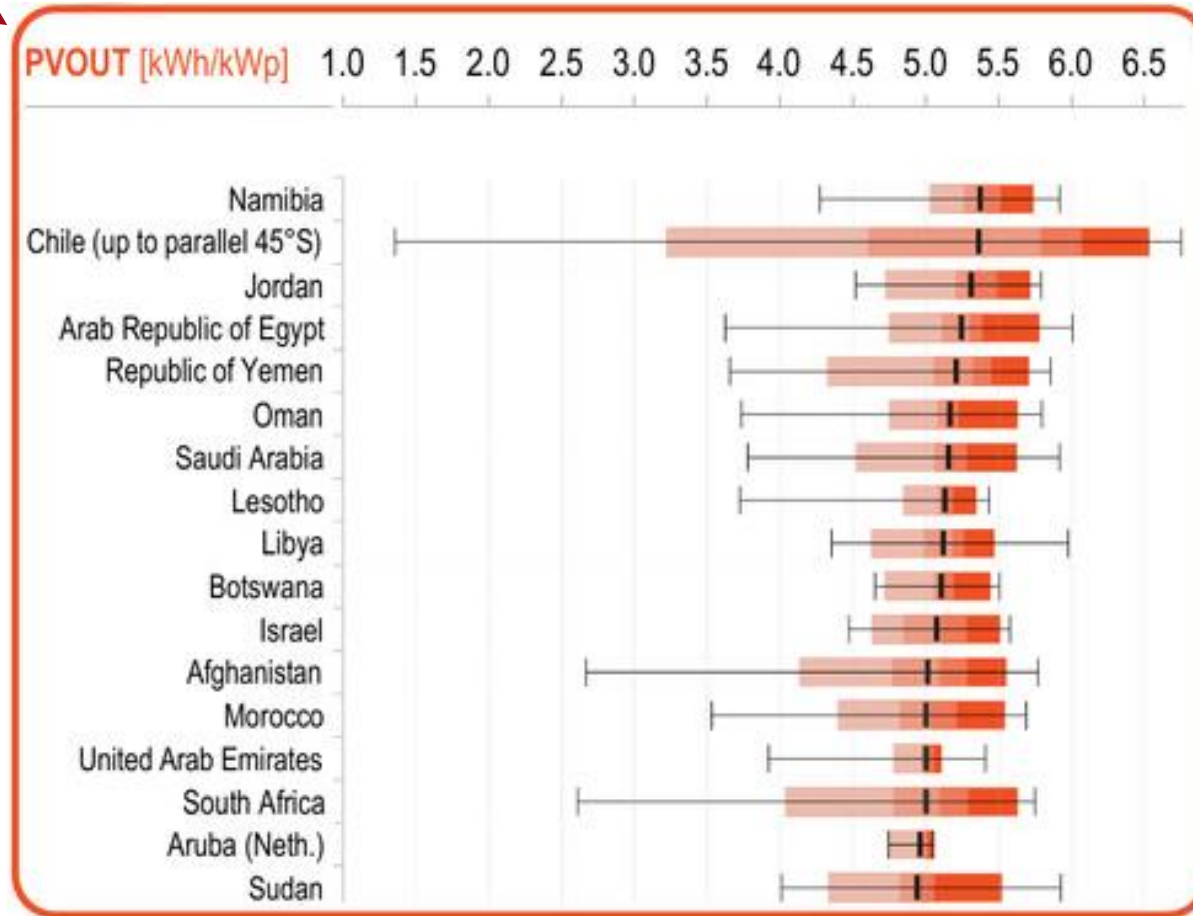
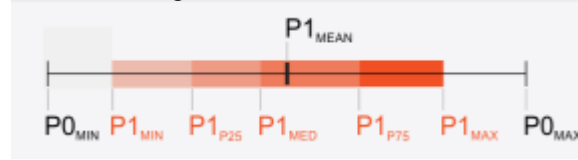
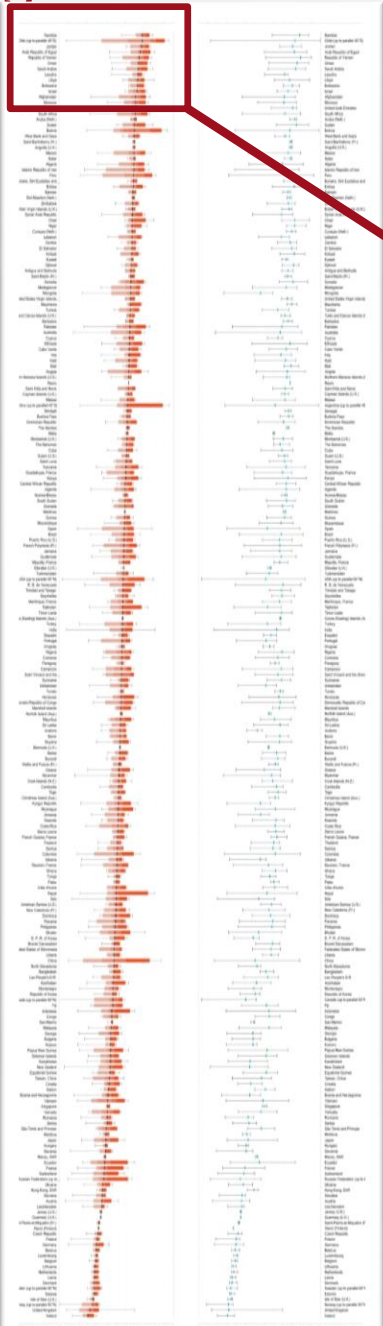
Long-term average of PVOUT



Excluded zones

globalsolaratlas.info – Štúdiá: Global Photovoltaic Power Potential By Country

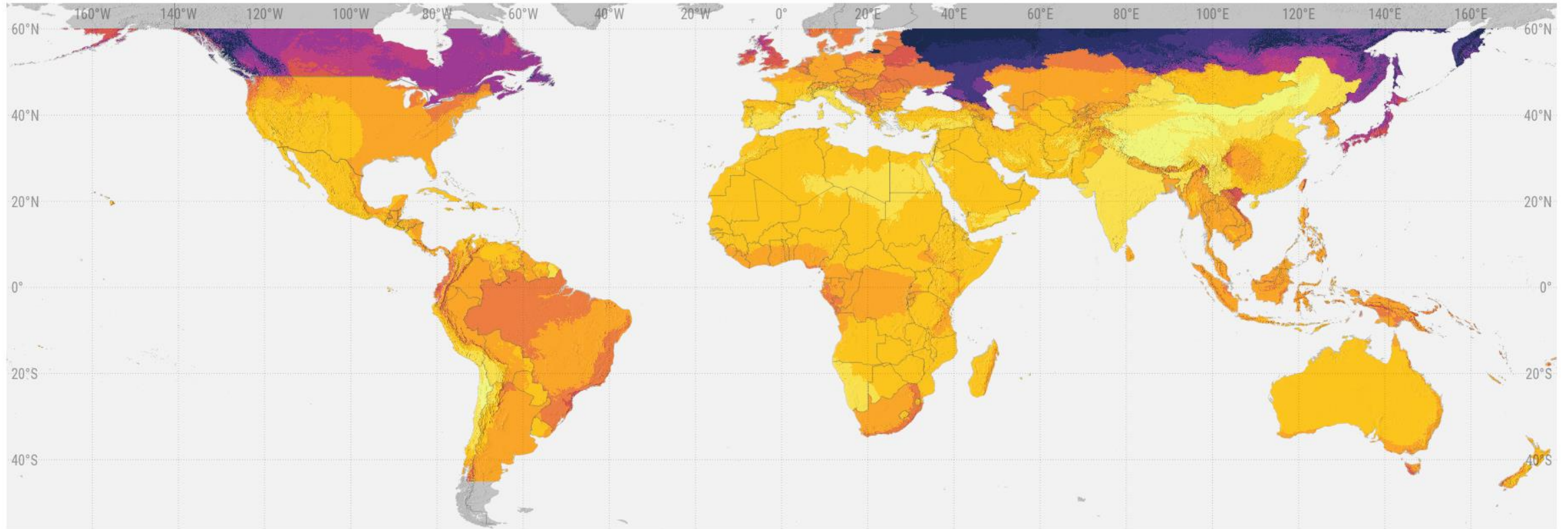
Výsledky zonálnej štatistiky



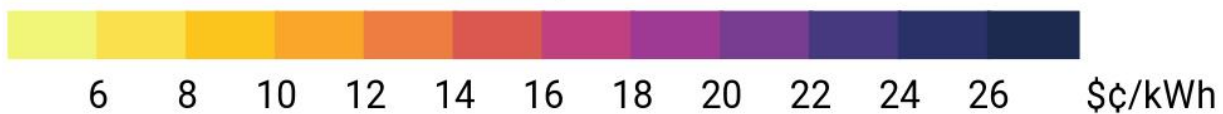
ISO_A3	country/region	pixel count	PVOUT_mea	PVOUT_max	PVOUT_min	PVOUT_med	PVOUT_p
NAM	Namibia	759153	5.38	5.74	5.02	5.40	5.40
CHL	Chile (up to parallel 45°S)	352827	5.36	6.53	3.21	5.78	4.40
JOR	Jordan	63662	5.32	5.72	4.71	5.28	5.40
EGY	Arab Republic of Egypt	318477	5.25	5.78	4.74	5.30	5.40
YEM	Republic of Yemen	283689	5.21	5.71	4.31	5.32	5.40
OMN	Oman	172120	5.17	5.63	4.74	5.14	5.40
SAU	Saudi Arabia	949058	5.16	5.62	4.51	5.18	5.40
LSO	Lesotho	26218	5.13	5.35	4.84	5.14	5.40
LBY	Libya	339623	5.12	5.47	4.61	5.18	4.40
BWA	Botswana	345976	5.11	5.45	4.71	5.11	5.40
ISR	Israel	26325	5.08	5.51	4.62	5.10	4.40
AFG	Afghanistan	528594	5.02	5.55	4.13	5.09	4.40
MAR	Morocco	461249	5.01	5.54	4.39	5.04	4.40
ARE	United Arab Emirates	53802	5.00	5.11	4.77	5.01	4.40
ZAF	South Africa	1371679	5.00	5.63	4.02	5.10	4.40
ABW	Aruba (Neth.)	184	4.96	5.05	4.74	4.99	4.40
SDN	Sudan	1043009	4.94	5.52	4.32	4.94	4.40
BOL	Bolivia	464812	4.94	6.37	3.83	4.38	4.40
PSE	West Bank and Gaza	7611	4.93	4.60	4.60	4.93	4.40
BLM	Saint-Barthélemy (Fr.)	20	4.93	4.98	4.85	4.93	4.40
AIA	Anguilla (U.K.)	92	4.93	4.99	4.85	4.92	4.40
MEX	Mexico	1716399	4.92	5.51	3.84	5.07	4.40
OAT	Qatar	13453	4.92	5.00	4.67	4.93	4.40
DZA	Algeria	710222	4.92	5.46	4.12	5.00	4.40
IRN	Islamic Republic of Iran	1631060	4.92	5.47	3.44	4.93	4.40
PER	Peru	386305	4.90	5.88	3.26	5.02	4.40
BES	Bonaire, Sint Eustatius and Saba	320	4.90	5.07	4.73	4.88	4.40
ERI	Eritrea	104995	4.89	5.39	4.15	5.00	4.40
BHR	Bahrain	764	4.87	5.02	4.64	4.87	4.40
SXM	Sint Maarten (Neth.)	29	4.87	4.96	4.79	4.86	4.40
ZWE	Zimbabwe	457404	4.86	5.15	4.44	4.90	4.40
VGB	British Virgin Islands (U.K.)	103	4.85	4.99	4.58	4.90	4.40
SYR	Syrian Arab Republic	209730	4.85	5.37	4.34	4.79	4.40
TCD	Chad	702610	4.84	5.54	4.58	4.77	4.40
NER	Niger	439586	4.84	5.32	4.52	4.81	4.40
CUW	Curaçao (Neth.)	507	4.83	5.00	4.59	4.84	4.40
LBN	Lebanon	11098	4.83	5.31	4.11	4.89	4.40
ZMB	Zambia	727282	4.83	5.04	4.55	4.84	4.40
SLV	El Salvador	20123	4.83	5.02	4.39	4.85	4.40
KIR	Kiribati	856	4.82	5.17	4.24	4.84	4.40
KWT	Kuwait	19194	4.82	4.89	4.63	4.82	4.40
DJI	Djibouti	23988	4.80	5.10	4.43	4.82	4.40
ATG	Antigua and Barbuda	503	4.77	4.97	4.48	4.78	4.40
MAF	Saint-Martin (Fr.)	45	4.76	4.95	4.66	4.76	4.40
SOM	Somalia	669425	4.76	5.44	4.20	4.72	4.40
MDG	Madagascar	560564	4.76	5.25	4.72	4.92	4.40
MNG	Mongolia	1287439	4.76	5.23	3.72	4.80	4.40
VIR	United States Virgin Islands (U.S.)	269	4.75	4.96	4.47	4.76	4.40
MRT	Mauritania	319346	4.75	5.29	4.58	4.70	4.40
TUN	Tunisia	165558	4.74	5.19	4.13	4.81	4.40
TCA	Turks and Caicos Islands (U.K.)	576	4.72	4.95	4.54	4.73	4.40
BRB	Barbados	422	4.72	4.89	4.49	4.71	4.40
PAK	Pakistan	843156	4.71	5.55	3.99	4.67	4.40

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LCOE – *Levelised cost of electricity* z veľkých fotovoltických elektrární

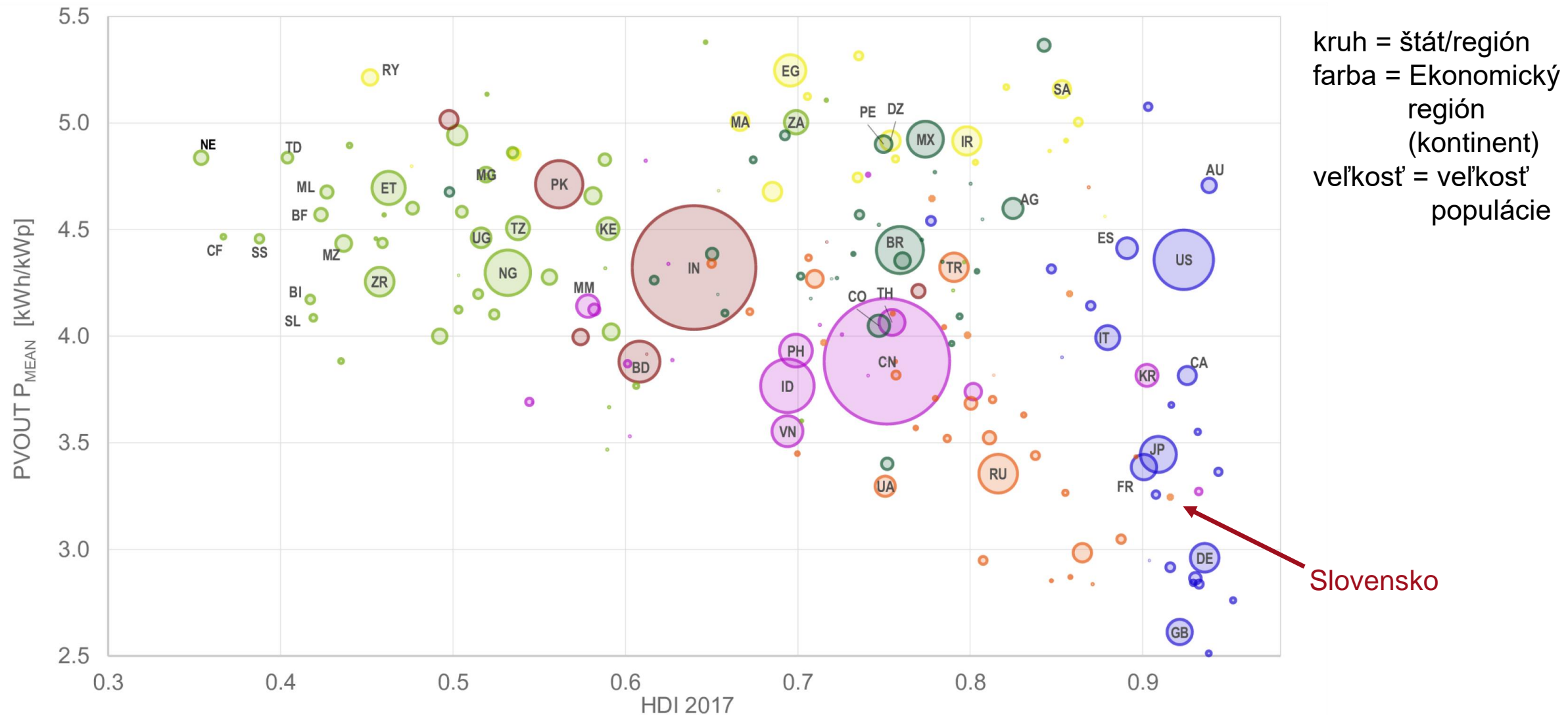


LCOE: Levelised cost of electricity

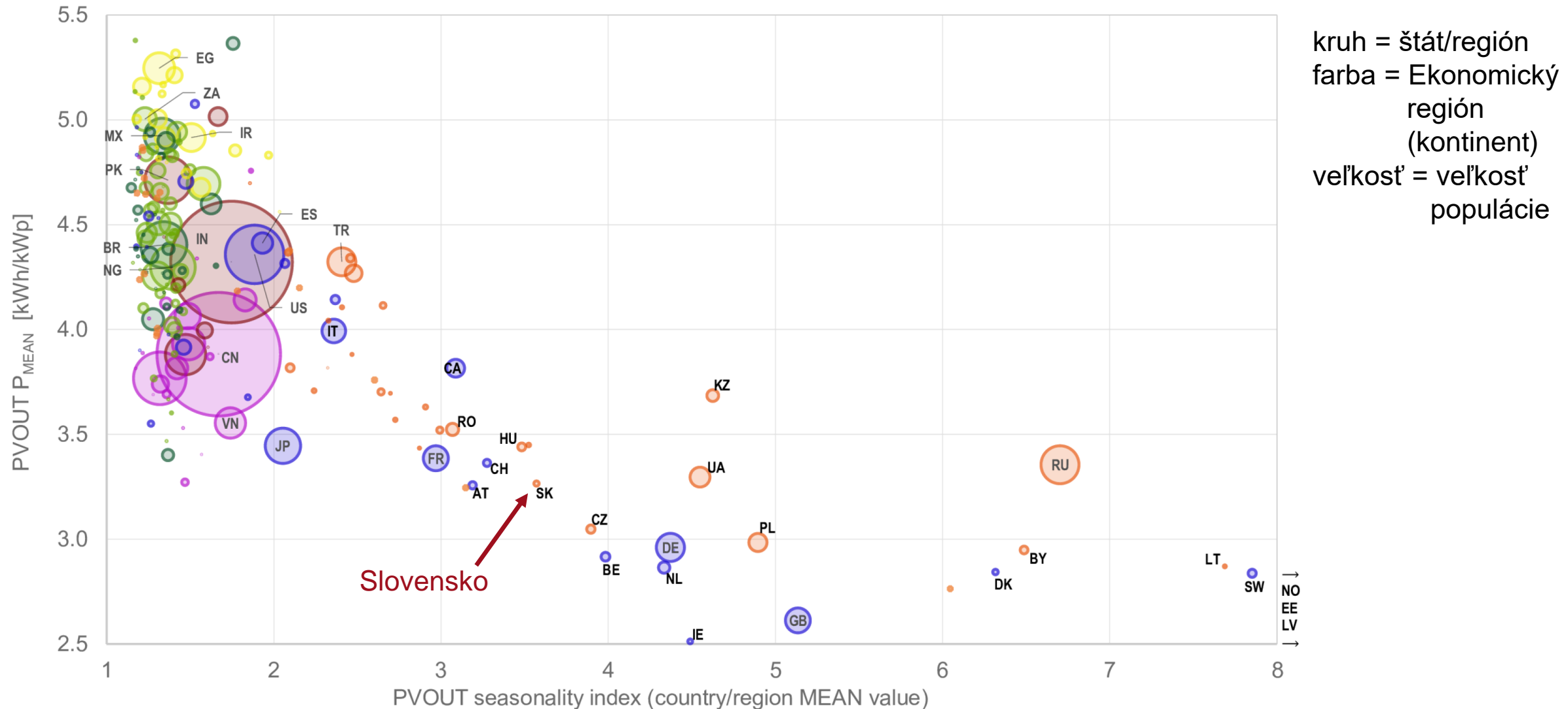


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Human development index VS Fotovoltický potenciál



Sezonalita VS Fotovoltický potenciál



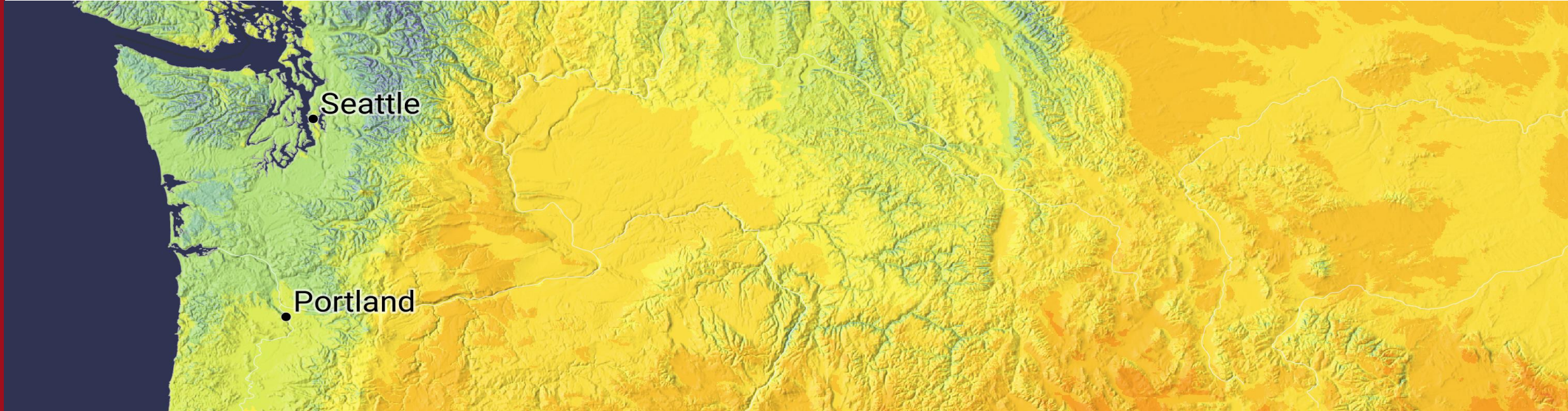
Záver

Geodáta

Kľúč pre pochopenie mechanizmov klimatickej zmeny
Svetová energetika je v transformácii, pre efektivitu a ekonomiku technológií OZE sú potrebné kvalitné geodáta

Kartografia

Mapy sú fenomén, *esperanto* ľudí decíznej sféry



GLOBAL SOLAR ATLAS

Geo-dáta a online nástroje pre podporu rozvoja solárnej energetiky

Marcel Šúri, Juraj Beták, Tomáš Cebecauer, Michal Moravčík, Šimon Štassel, Konštantín Rosina, Artur Skoczek, Peter Orosi

Solargis s.r.o., Mýtna 48, 811 07 Bratislava, contact@solargis.com