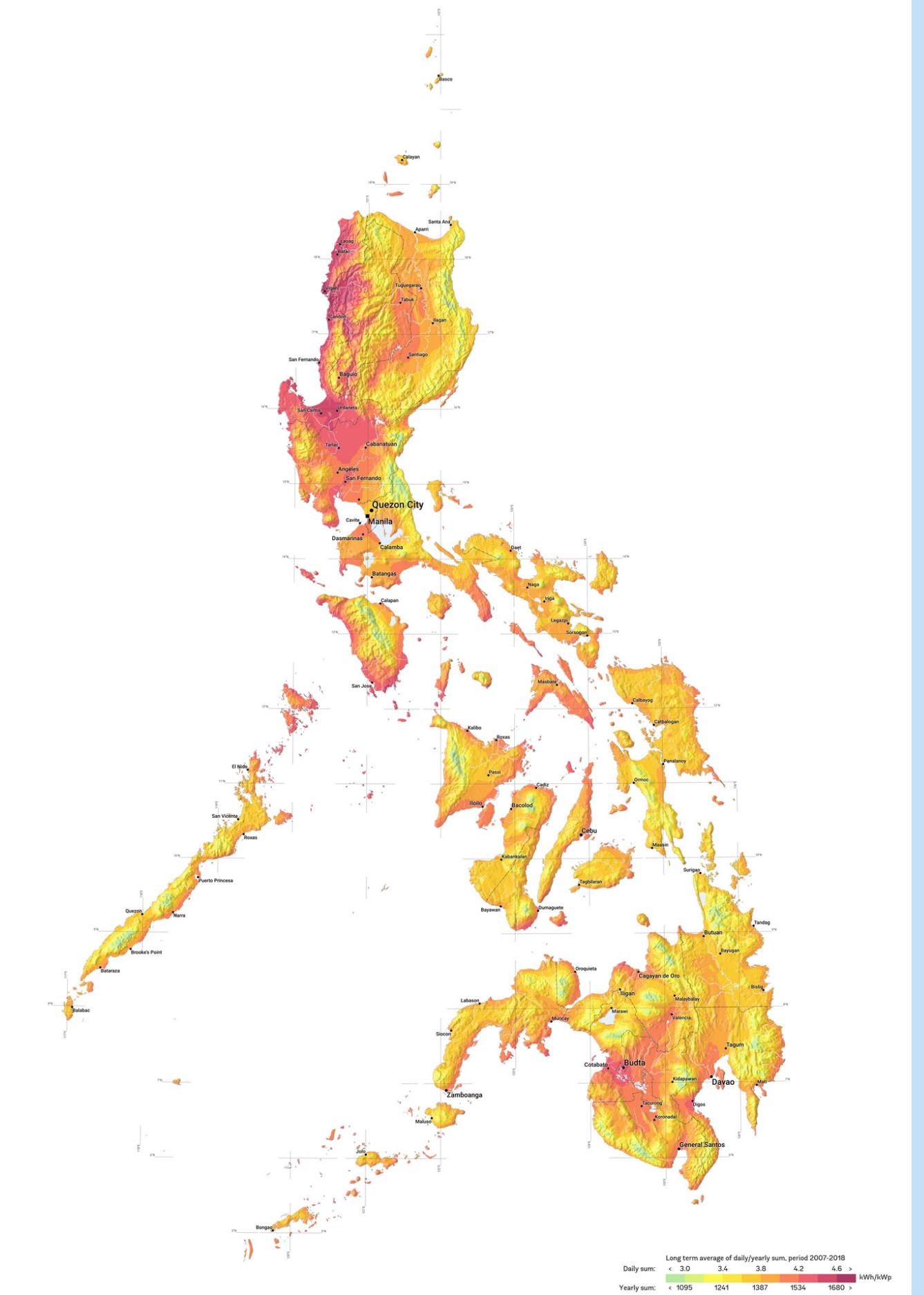
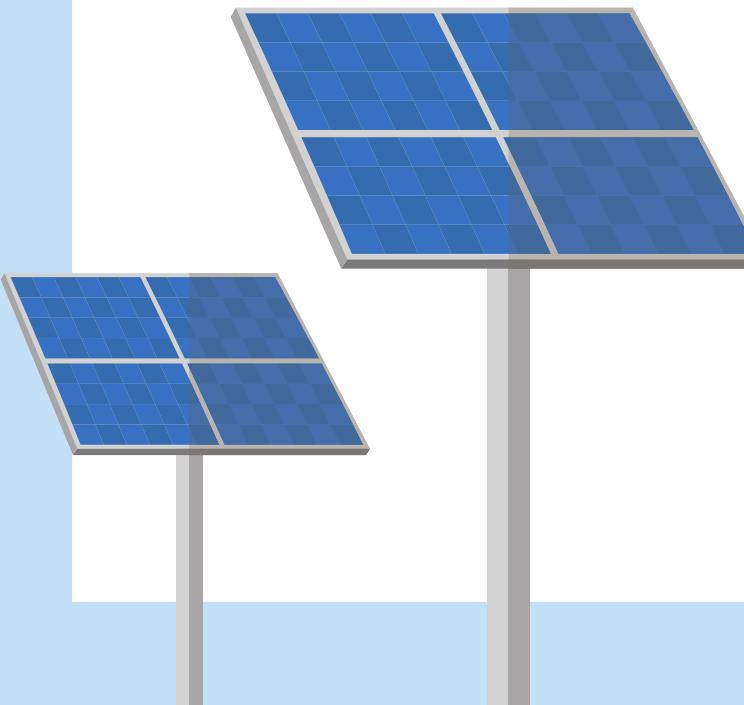


Lights On!

Predicting the solar capacity of solar farms
in Luzon using Geospatial and Machine
Learning Approach



Long term average of daily/yearly sum, period 2007-2018
Daily sum: < 3.0 3.4 3.8 4.2 4.6 > kWh/kWp
Yearly sum: < 1095 1241 1387 1534 1680 > kWh/kWp

Philippine power reserves thin but no red alert just yet

By: [Jordeene B. Lagare](#) - [@inquirerdotnet](#)

Philippine Daily Inquirer / 09:50 AM February 20, 2023

NGCP warns of tight power supply this summer

[Richmond Mercurio](#) - The Philippine Star 

Be prepared for thin power supply this summer

BY MANILA BULLETIN

Solar Philippines begins working on 4 GW solar park

Solar Philippines says it has broken ground on what it touted to be the world's largest solar array – a 4 GW solar park spread across 3,500 hectares of land in the northern part of the country.

JANUARY 2, 2024 **ANGELA SKIJINS**

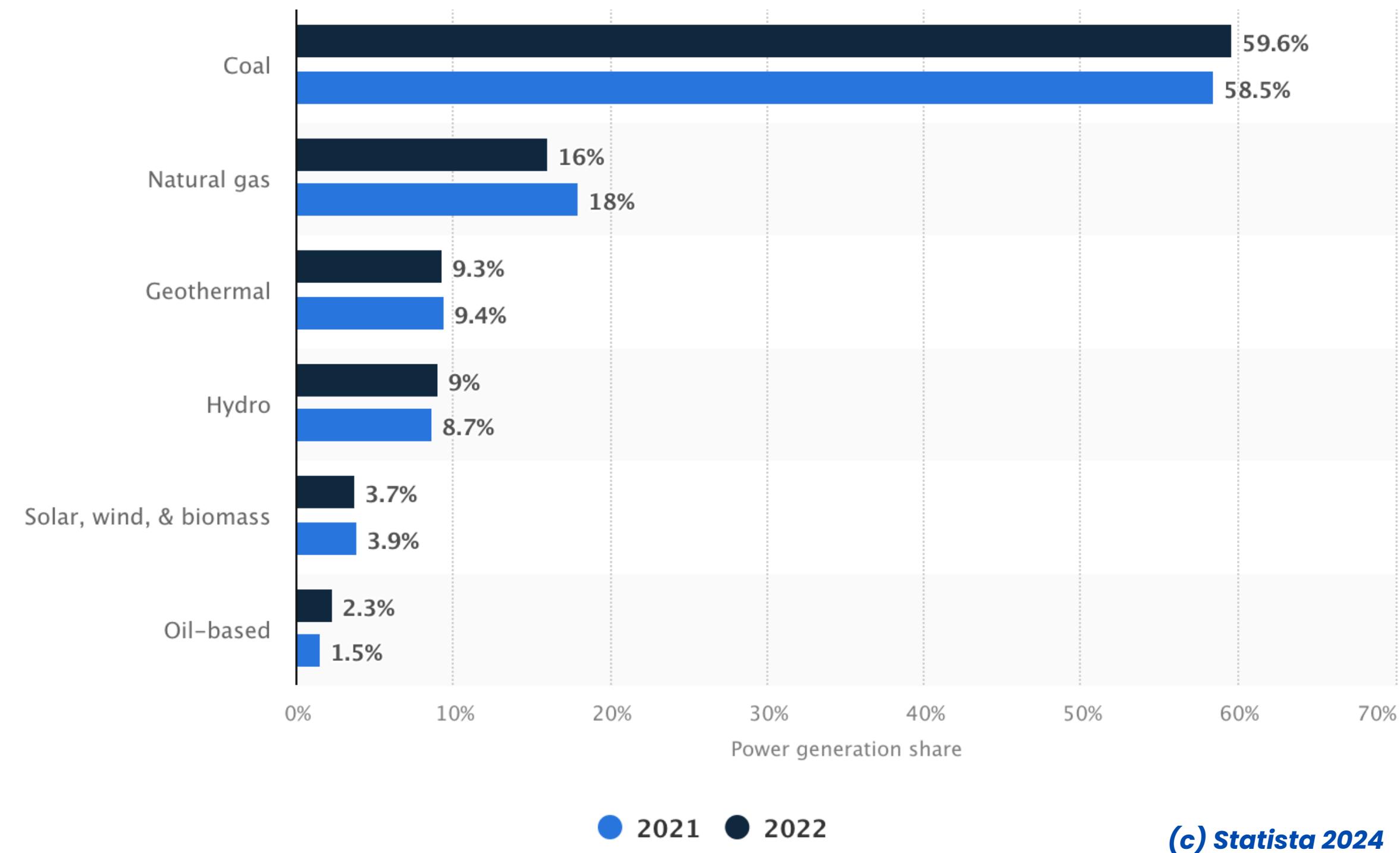
200MW Solar Plant Eyed in Paoay, Ilocos Norte

POWER PHILIPPINES NEW

Meralco unit to invest P200B in PH's biggest solar farm

By: **Meg J. Adonis** - @inquirerdotnet

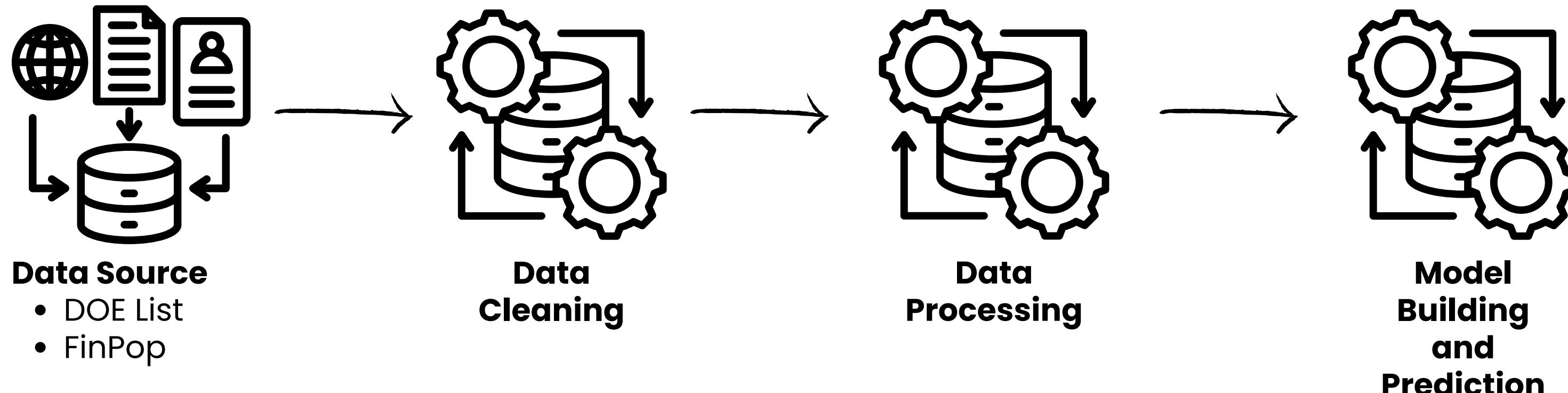
Energy Share in the Power Sector



Objective/s:

- To develop a predictive model using geospatial analysis and machine learning (ML) to estimate the solar farm capacity requirements in Luzon.
- To identify key factors affecting solar farm capacity for development.

Methodology:



API Call:

- PowerAPI
- ElevationAPI
- OpenStreetMaps

Datasets used:



DOE List of Existing
Solar Farm



Financial
Pop

API used:



PowerAPI



Elevation
API



OpenStreetMap
The Free Wiki World Map

OpenStreetMap

List of Existing Substations:

	FACILITY NAME	INSTALLED	REGION	OWNER / IPPA	LATITUDE	LONGITUDE
0	CALATAGAN SOLAR	63.3	4-A	Solar Philippines Calatagan Corporation	13.924153	120.672537
1	CLARK SOLAR	22.3	3	Citicore Renewable Energy Corporation\n(former...	15.227867	120.558629
2	CONCEPCION 1 SOLAR	20.7	3	Solar Philippines Tarlac Corporation	15.373445	120.611898
3	CONCEPCION 2 SOLAR	70.9	3	Solar Philippines Tarlac Corporation	15.373445	120.611898
4	CURRIMAO SOLAR	20.1	1	Mirae Asia Energy Corporation	18.050515	120.491744
5	MARIVELES SOLAR	18.0	3	Citicore Solar Bataan, Inc.\n(Formerly: Next G...	14.451576	120.537802
6	PETROSLAR	50.1	3	PetroSolar Corporation	15.448468	120.643307
7	PETROSLAR 2	20.0	3	PetroSolar Corporation	15.448468	120.643307
8	STA. RITA SOLAR (Phase I, II and 3A)	62.4	3	Jobin-Sqm Inc. (JOBIN)	14.809150	120.364511
9	STA.RITA SOLAR (Phase 3B)	34.4	3	Jobin-Sqm Inc. (JOBIN)	14.809150	120.364511

Department of Energy: List of Existing Power Plants

SOLAR RESOURCE MAP

PHOTOVOLTAIC POWER POTENTIAL PHILIPPINES



DESCRIPTION

This solar resource map provides a summary of estimated solar photovoltaic power generation potential. It represents the total daily/yearly total of electricity production from a 1 kW-peak grid-connected solar PV power plant, calculated for a period of 12 recent years (2007-2018). The PV system configuration consists of ground-based, free-standing structures with crystalline-silicon PV modules mounted at a fixed position, with optimum tilt to maximize yearly energy yield. The optimum tilt ranges from 4° to 21° towards the equator. Use of high efficiency inverters is assumed. The solar electricity potential is based on high-resolution weather reanalysis and PV module software provided by Solargis. The calculation takes into account solar radiation, air temperature, and terrain, to simulate the energy conversion and losses in the PV modules and other components of a PV power plant. In the simulation, losses due to dirt and soiling was estimated to be 3.5%. The cumulative effect of other conversion losses (inter-row shading, mismatch, inverters, cables, transformer, etc.) is assumed to be 7%. The power availability is considered to be 100%. The underlying solar resource database is calculated from atmospheric and satellite data with a 30-minute time step, and a spatial resolution of 1000 m.

ABOUT

The World Bank Group has published this solar resource map using data from the Global Solar Atlas (GSA), to support the development of renewable energy projects. This work is funded by the Energy Sector Management Assistance Program (ESMAP), a multi-donor trust fund administered by The World Bank and supported by 18 donor partners. It is part of a global ESMAP initiative on Renewable Energy Resource Mapping that covers biomass, hydropower, solar and wind. This map has been prepared by Solargis, under contract to The World Bank, based on a solar resource database that Solargis owns and maintains.

To obtain additional maps and information, please visit:

<http://globalsolaratlas.info>

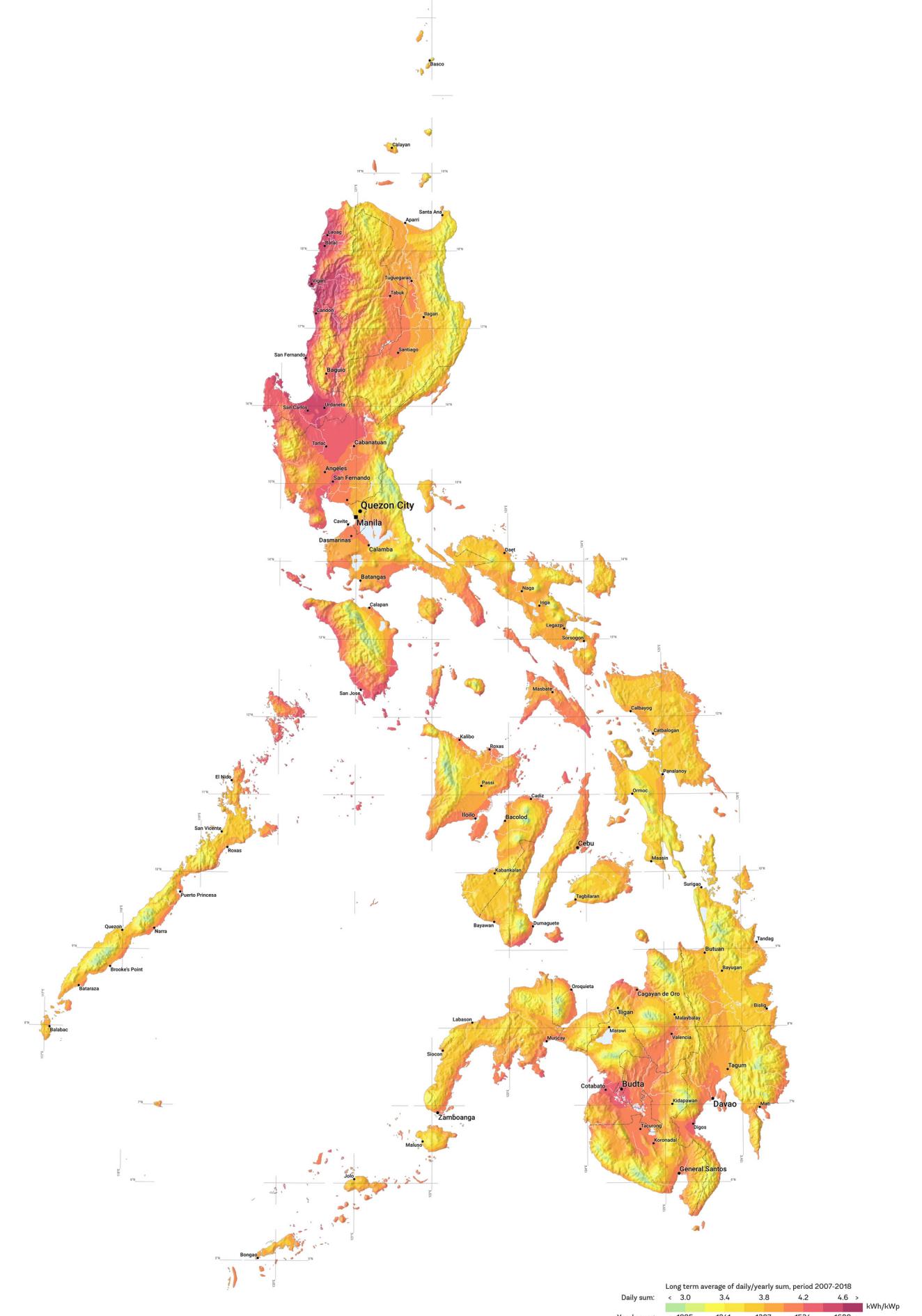
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1818 H Street NW Washington DC 20433, USA
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Map data sources:
Solar resource databases and photovoltaic simulation software: © 2019 Solargis
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Please cite: Solargis, 2019. Solar Resource Potential in the Philippines. [https://globalsolaratlas.info/support](http://globalsolaratlas.info/support).

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The boundaries, colors, denominations and any other information shown on this map do not imply official endorsement or acceptance on the legal status of any territory, or any endorsement or acceptance of such boundaries.

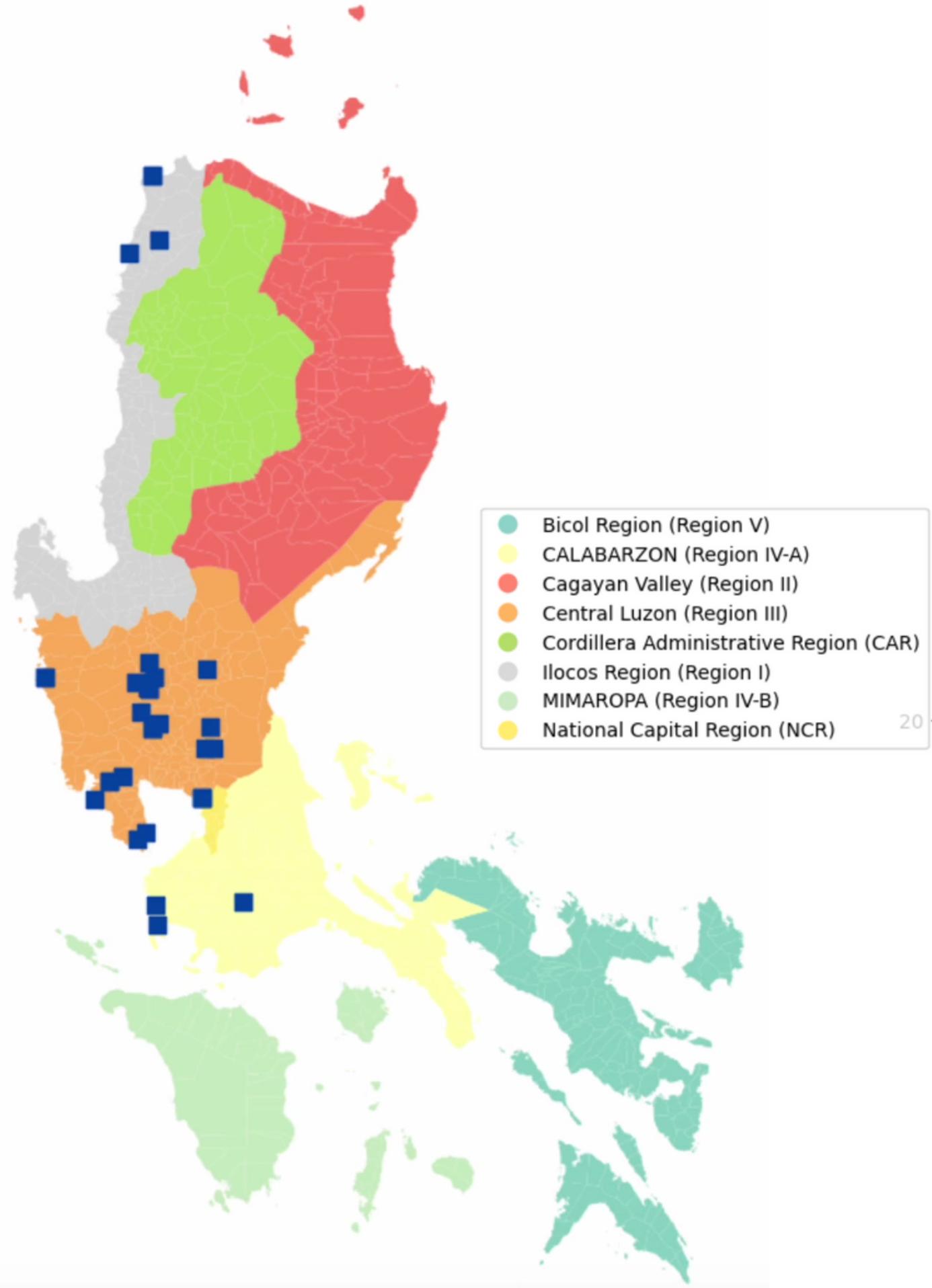
Source: Global Solar Atlas 2.0 • Solargis database version: 2.1 • Map issue date: 2019-10-17



All Sky Surface Shortwave Downward Irradiance (w/m²)

total amount of solar irradiance that reaches the Earth's surface from the sun, including both the direct sunlight and the indirect sunlight.

Measured in w/m².



23 solar farms are
in **Region III**.
4 in **Region 1**
3 in **Region IV-A**
3 in **NCR**

API Call

PowerAPI

	T2M_RANGE	TS	T2MDEW	T2MWET	T2M_MAX	T2M_MIN	T2M	QV2M	RH2M	PRECTOTCORR	PS	WS10M	WS10M_MAX	WS10M_MIN	WS10M_RANGE	WS50M	WS50M_MAX	WS50M_MIN	WS50M_RANGE	ALLSKY_SFC_SW_DWN
20230104	3.06	26.60	23.96	25.02	28.02	24.96	26.08	18.62	88.12	17.23	100.41	7.59	9.42	6.27	3.16	9.55	11.53	8.11	3.42	1.87
20230105	2.32	26.70	24.42	25.34	27.74	25.42	26.27	19.17	89.56	25.38	100.45	6.45	7.72	4.41	3.30	8.11	9.28	5.95	3.34	3.39
20230106	1.95	26.59	24.56	25.37	27.23	25.26	26.18	19.29	90.75	20.76	100.51	5.57	6.76	4.39	2.37	7.05	8.67	5.45	3.22	4.27
20230107	3.37	26.11	22.76	24.12	27.44	24.08	25.48	17.27	85.06	0.84	100.52	7.10	9.08	5.88	3.20	8.95	10.91	7.91	3.01	5.28
20230108	3.45	25.52	21.37	23.05	26.90	23.46	24.71	15.87	81.88	0.21	100.69	6.95	8.52	5.82	2.70	8.89	10.12	7.84	2.28	4.91



	FACILITY NAME	INSTALLED	REGION	OWNER / IPPA	LATITUDE	LONGITUDE	Average ALLSKY_SFC_SW_DWN
0	CALATAGAN SOLAR	63.3	4-A	Solar Philippines Calatagan Corporation	13.924153	120.672537	5.027507
1	CLARK SOLAR	22.3	3	Citicore Renewable Energy Corporation\n(former...	15.227867	120.558629	5.212548
2	CONCEPCION 1 SOLAR	20.7	3	Solar Philippines Tarlac Corporation	15.373445	120.611898	5.212548
3	CONCEPCION 2 SOLAR	70.9	3	Solar Philippines Tarlac Corporation	15.373445	120.611898	5.212548
4	CURRIMAO SOLAR	20.1	1	Mirae Asia Energy Corporation	18.050515	120.491744	5.365589

*Average ALLSKY Irradiance

Concepcion Solar Farm and Tarlac Substation



	Data
Area (sq.m)	1,673,779.57
Land Elevation (m)	46.82
Lat, Long	{15.373445, 120.611898}
Avg. Solar Irradiance (w/m²)	5.212548
Distance to nearest substation (m)	351.23
Distance to nearest road (m)	170.21
Population	154,188.00

Model Building and Prediction

Model	Train MSE	Test MSE	Train R^2	Test R^2
Ridge	14.279687	33.492773	0.984869	0.976386
Lasso	18.326471	50.829279	0.980582	0.964162
LinearRegression	11.898778	55.428978	0.987392	0.960919
GradientBoostingRegressor	0.000014	191.751810	1.000000	0.864804
RandomForestRegressor	6.653589	291.529137	0.992950	0.794455
DecisionTreeRegressor	0.000000	393.660000	1.000000	0.722447
KNNRegressor	279.433491	1011.643467	0.703916	0.286734

80-20 Train_Test Split
22 cv

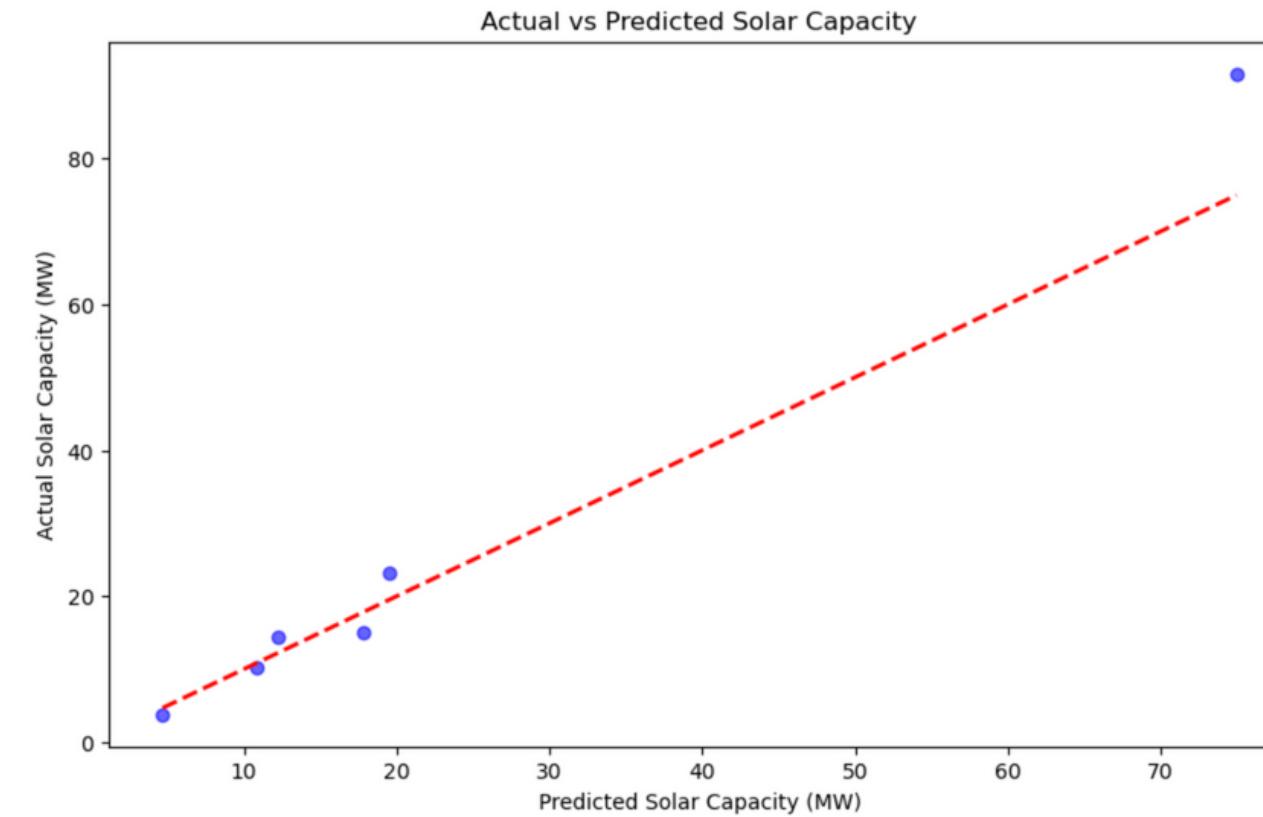
Model Building and Prediction

Model	Train MSE	Test MSE	Train R ²	Test R ²
Ridge	14.279687	33.492773	0.984869	0.976386

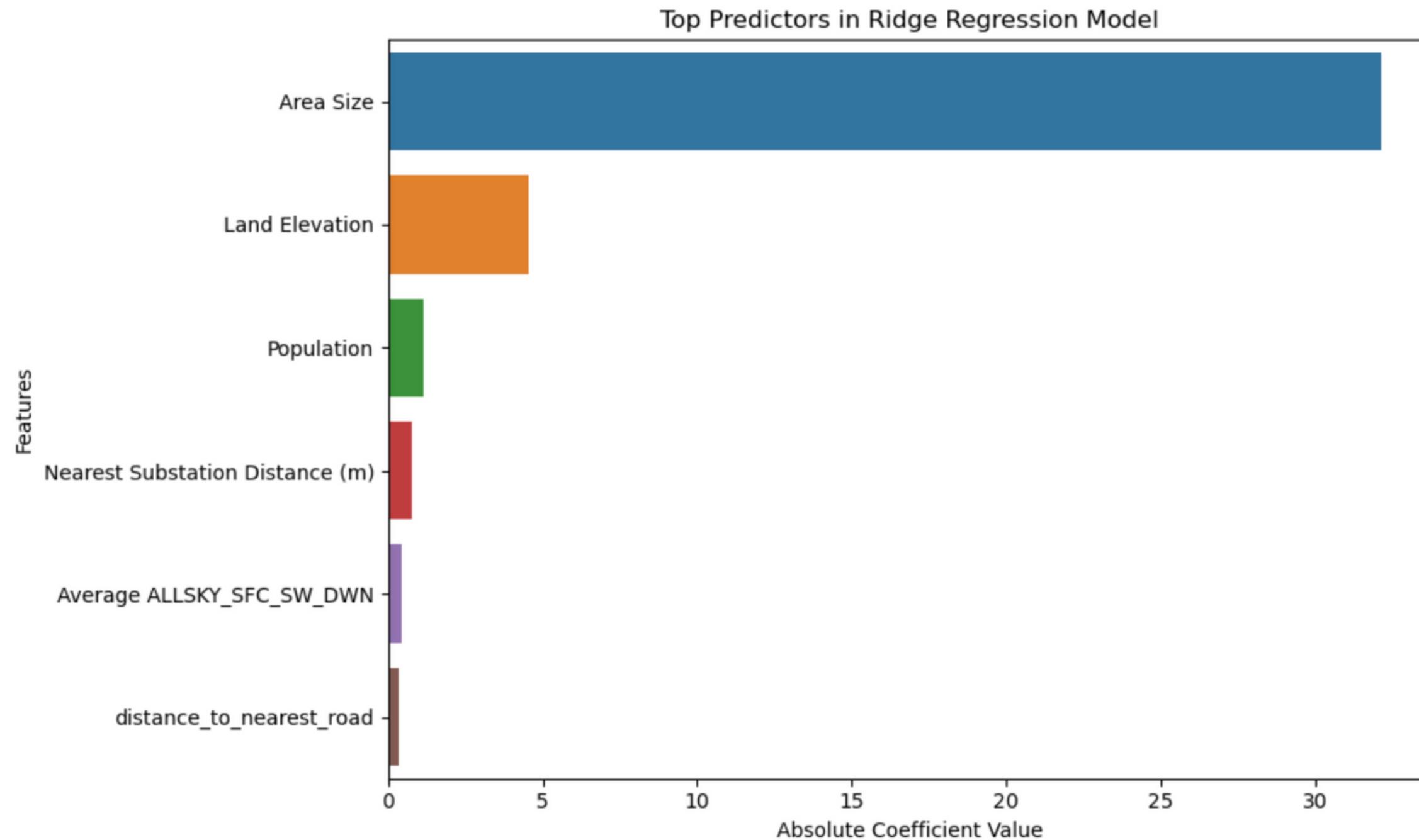
*best_params: {'alpha': 100, 'solver': 'saga'}

Prediction:

	Actual	Predicted	Difference
18	10.3	10.809593	0.509593
24	23.1	19.498157	3.601843
7	14.5	12.205604	2.294396
16	15.0	17.795303	2.795303
2	91.6	74.956583	16.643417



Model Building and Prediction



Conclusion

- Regions 1 and 3 are identified as having the highest potential for solar energy development making them optimal locations for investing in solar energy infrastructure.
- Best performing model was Ridge Regression(L2) with an MSE of 33.49 and R2 of 0.97.
- Top predictor is Area Size, followed by the land elevation.
- There is a distinct relationship between capacity and area size,
 - 0.8-1.1 MW corresponds to 10,000 sq. m (1 hectare)