MULTI-CRITERIA ANALYSIS FOR PLANNING RENEWABLE ENERGY (MapRE)

Attribute table descriptions for shape files and pdf maps

Blue highlighted cells indicate attributes that are specific to wind zones, orange highlighted cells indicate attributes specific to solar CSP zones, and yellow highlighted cells indicate attributes specific to solar PV. All other attributes are common between technologies.

For details on methods and calculations, please see Wu GC, Deshmukh R, Ndhlukula K, Radojicic T, Reilly J (2015) "Renewable Energy Zones for the Africa Clean Energy Corridor", *International Renewable Energy Agency and Lawrence Berkeley National Laboratory*, Berkeley, CA, LBNL#187271.

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ATTRIBUTE NAME	FIELD NAME SHP FILE (Zones)	FIELD NAME SHP FILE (Projects)	DESCRIPTION
zone_identification	zoneid	zone_id	This is the unique alphabetical identifier for the zones. Zones are labeled on the map using this identifier. Projects are subsets of zones.
Electricity generation attributes:			Estimated annual average electricity generation in MWh for the following:
A) Electricity_generation_discounted_MWhPerYr	egen	electgen	**Solar PV**, assuming a 90% land use discount factor.
B) Electricity_generation_discounted_chosenTurbine_MWhPerYr	egen_ch	electgen_c	**Wind** using the optimally selected IEC turbine class, assuming a 75% land use discount factor.

C) Electricity_generation_discounted_classIIturbine_MWhPerYr	egen_cii	electgen_0	**Wind** using IEC Class II turbines, assuming a 75% land use discount factor.
D) Electricity_generation_discounted_noStorage_MWhPerYr	egen_0h	electgen_0	**Solar CSP** without storage, assuming a 90% land use discount factor.
E) Electricity_generation_discounted_6hrsStorage_MWhPerYr	egen_6h	electgen_6	**Solar CSP** with 6 hours of storage, assuming a 90% land use discount factor.
Potential installed capacity attributes:			Potential capacity (MW) that could be installed within a zone for the following:
installedCapacity_MW	incap	installedc	**Solar PV or wind**, assuming a 90% and 75% land use discount factor, respectively.
installedCapacity_noStorage_MW	incap_0h	Installed	**Solar CSP** without storage, assuming a 90% land use discount factor.
installedCapacity_6hrsStorage_MW	incap_6h	Installed0	**Solar CSP** with 6 hours of storage, assuming a 90% land use discount factor.
area_km2	area_km2		Total area of the zone in units of square kilometers
Levelized cost of electricity (LCOE) of non-generation components attributes:			Average levelized cost of electricity (in USD/MWh) for the non-generation components of the following (values are only reported if transmission or substation data could be procured):
A) LCOE_transmission_USDperMWh	l_tra	p_transcos	**Solar PV**, estimated using distance to the nearest transmission line, if available.
B) LCOE_substation_USDperMWh	l_sub	p_subcost	**Solar PV**, estimated using distance to the nearest substation, if available.
C) LCOE_road_USDperMWh	l_road	p_roadcost	**Solar PV**, estimated using distance to the nearest road.
D) LCOE_transmission_chosenTurbine_USDperMWh	l_tra_ch	p_transcos	**Wind** using the optimally selected IEC turbine, estimated using nearest transmission line.
E) LCOE_substation_chosenTurbine_USDperMWh	l_sub_ch	p_subcost	**Wind** using the optimally selected IEC turbine, estimated using nearest substation.
F) LCOE_road_chosenTurbine_USDperMWh	l_road_ch	p_roadcost	**Wind** using the optimally selected IEC turbine, estimated using nearest road.
G) LCOE_transmission_6hrsStorage_USDperMWh	l_tra_6h	p_transcos	**Solar CSP** with 6 hours of storage, estimated using nearest transmission line.
H) LCOE_substation_6hrsStorage_USDperMWh	l_sub_6h	p_subcost	**Solar CSP** with 6 hours of storage, estimated using nearest substation.

I) LCOE_road_6hrsStorage_USDperMWh	l_road_6h	p_roadcost	**Solar CSP** with 6 hours of storage, estimated using nearest road.
Levelized cost of electricity (LCOE) of generation component attributes:			Average levelized cost of electricity (in USD/MWh) for generation component of the following technologies (values were estimated using the location's capacity factor and efficiencies specific to the technology):
A) LCOE_generation_USDperMWh	l_gen	p_lcoegen	**Solar PV**
B) LCOE_generation_chosenTurbine_USDperMWh	l_gen_ch	p_lcoegen_	**Wind** using the optimally selected IEC turbine class.
C) LCOE_generation_classIIturbine_USDperMWh	l_gen_cii	p_lcoegen0	**Wind** using IEC Class II turbine.
D) LCOE_generation_noStorage_USDperMWh	l_gen_0h	p_lcoegen_	**Solar CSP** without storage.
E) LCOE_generation_6hrsStorage_USDperMWh	l_gen_6h	p_lcoegen0	**Solar CSP** with 6 hours of storage.
Total levelized cost of electricity (LCOE) attributes:			Average total levelized cost of electricity estimated by summing the individual component LCOEs for generation, transmission line or substation (values are only available if data could be procured), and road for the following:
A) LCOE_total_transmission_USDperMWh	lt_tra	p_lcoetott	**Solar PV**, estimated using the transmission component.
B) LCOE_total_substation_USDperMWh	lt_sub	p_lcoetots	**Solar PV**, estimated using the substation component.
C) LCOE_total_transmission_chosenTurbine_USDperMWh	lt_tra_ch	p_lcoetott	**Wind** using the optimally selected IEC turbine class, estimated using transmission
D) LCOE_total_transmission_classIIturbine_USDperMWh	lt_tra_cii	p_lcoetot0	**Wind using IEC Class II turbine, estimated using transmission**
E) LCOE_total_substation_chosenTurbine_USDperMWh	lt_sub_ch	p_lcoetots	**Wind** using the optimally selected IEC turbine class, estimated using substation
F) LCOE_total_substation_classIIturbine_USDperMWh	lt_sub_cii	p_lcoetot1	**Wind** using IEC Class II turbine, estimated using substation
G) LCOE_total_transmission_noStorage_USDperMWh	lt_tra_0h	p_lcoetott	**Solar CSP** without storage, estimated using transmission
H) LCOE_total_transmission_6hrsStorage_USDperMWh	lt_tra_6h	p_lcoetot0	**Solar CSP** with 6 hours of storage, estimated using transmission

I) LCOE_total_substation_noStorage_USDperMWh	lt_sub_0	p_lcoetots	**Solar CSP** without storage, estimated using substation
J) LCOE_total_substation_6hrsStorage_USDperMWh	lt_sub_6	p_lcoetot1	**Solar CSP** with 6 hours of storage, estimated using substation
mean_slope_percent	m_slope	p_slope	Mean slope of the zone in units of percent rise.
mean_populationDensity_personsPerKm2	m_popden	p_popden	Mean population density of the zone in units of persons per square kilometer.
mean_HumanFootprint_0to100	m_humfoot	p_humanfoo	Mean human footprint metric (0 – least human impact; 100 – most human impact)
mean_LULC_score	m_lulc	p_lulc	Mean score for land use/land cover categories in the zone. Scores range from 1 to 5, with 1 being most compatible for energy development and 5 being least compatible.
Mean_colocation_score	m_coloc	p_sccoloc (mean of p_coloc_pv, p_coloc_cs, p_coloc_wi – other two technologies)	Mean score for the suitability of the zone for other renewable energy technologies. For example, the attribute table of a solar PV zone would display the colocation score calculated using the zone's overlap with wind and CSP potential. The score ranges from 0 to 1, with 0 being no overlap and 1 being overlap with both renewable technologies.
Num_projectsWithWaterAccess	n_water	- (based on d_wat)	Number of project opportunity areas within the zone that is within 10 km of surface water.
mean_resourceQuality_Wperm2	m_rq_wm2		Mean resource quality in terms of wind power density or solar irradiance of the zone in units of watts per m2.
mean_resourceQuality_kWhPerm2Day	m_rq_kwh		Mean solar resource quality of the zone in units of annual average kWh per m2 per day.
Capacity factor attributes:			Mean capacity factor of the zone for the following (values range from 0 to 1):
A) mean_capacityFactor	m_cf		**Solar PV**
B) mean_capacityFactor_chosenTurbine	m_cf_ch		**Wind using the optimally selected IEC turbine class.**
C) mean_capacityFactor_classIIturbine	m_cf_cii		**Wind using IEC Class II turbine.**
D) mean_capacityFactor_noStorage	m_cf_0h		**Solar CSP** without storage.

E) mean_capacityFactor_6hrsStorage	m_cf_6h		**Solar CSP** with 6 hours of storage.
area_chosenTurbine_classIII_km2	a_ch_ciii		Area (in km2) within the zone for which IEC class III turbines would be most suitable
area_chosenTurbine_classII_km2	a_ch_cii		Area (in km2) within the zone for which IEC class II turbines would be most suitable
area_chosenTurbine_classI_km2	a_ch_ci		Area (in km2) within the zone for which IEC class I turbines would be most suitable
Distance attributes:			Distance to the nearest following locations (in units of kilometers):
A) distance_nearest_transmission_km	d_trans	d_tra	Transmission line
B) distance_nearest_substation_km	d_sub	d_sub	Substation
C) distance_nearest_road_km	d_road	d_roa	Road
D) distance_nearest_existingPlanned_wind_km (or distance_nearest_existingPlanned_PV_km, distance_nearest_existingPlaned_CSP_km)	d_wind, d_pv, d_csp	d_win, d_pv, d_csp	Operational or planned wind (or solar PV, solar CSP) power plant.
E) distance_nearest_geothermalLocation_km	d_geo	d_geo	Operational or planned geothermal power plant.
F) distance_nearest_anyRenewableEnergyLocation_km	d_anyre	d_any	Operational or planned renewable energy (wind, solar PV, solar CSP, geothermal) power plant.
G) distance_nearest_majorCity_km	d_load	d_loa	Major city or load center.
H) distance_nearest_waterSource_km	d_water	d_wat	Surface water (lake or river) source.
GroupVal		groupval	Identifier that is used to assign a project opportunity area to a zone.
Capacity value attributes:			
A) distance_nearest_3TierWindLocation_km	d_windhour		From the centroid of the zone, distance in km to the nearest location where simulated wind speed time series data were acquired from 3Tier. Hourly time series were used to estimate capacity value ratios.
B) capacityValueRatio_10percentPeakHours	cvr_10per		The ratio of the capacity factor for the top 10% of hours with the largest electricity demand within a year (876 hrs) to the capacity factor of all hours within the same year (8760 hrs).
C) capacityValueRatio_chosen3peakHours	cvr_ch3h		The ratio of the capacity factor for the daily top 3 hours with the largest electricity demand across an

			entire year (1095 hrs) to the capacity factor of all hours within the same year (8760 hrs).
D) capacityValueRatio_chosen3peakHours_multiyear	cvr_ch3h_m		The ratio of the capacity factor for the daily top 3 hours with the largest electricity demand across an entire year, extrapolated to 10 years (10,950 hrs), to the capacity factor of all hours within the same 10 years (87,600 hrs). 3Tier provided 10 years of hourly time series data for each point location.
E) adjustedCF_top10percent	cf_cvr_10p		The capacity factor of the top 10% of hours with the largest electricity demand within a year (876 hrs). This value was estimated by multiplying the capacityValueRatio_10percentPeakHours with the mean_capacityFactor_chosenTurbine.
F) adjustedCF_top3hrs	cf_cvr_ch3		The capacity factor of the daily top 3 hours with the largest electricity demand across an entire year (1095 hrs). This value was estimated by multiplying the capacityValueRatio_chosen3peakHours with the mean_capacityFactor_chosenTurbine.

Additional notes:

1) Attribute table field names in shape files are truncated because of shape file constraints on number of characters.
2) Full attribute names provided in first column can be found in the pdf map.
3) Distances in “project” geospatial files are in meters, while distances in “zones” geospatial files are in km.
4) Resource quality not provided for “projects” due to licensing issues associated with raw resource data sets. Average resource quality data sets are not available on IRENA’s Global Atlas and the World Bank’s Global Solar and Wind Atlases.
5) Capacity factors may not be recorded for “projects” but can be derived from electricity generation potential and installed capacity.
6) Area for “projects” can be estimated using Shape_Area attribute.
7) Some attributes including capacity value and adjusted capacity factors are estimated only for “zones” and not “projects”.