**TMY3 Column Data Descriptions**

**\*\*\*Note\*\*\***

**Each column containing “source” or “uncert (%)” are not immediately important to the machine learning algorithm and can be removed from the joined data without any real repercussion. This being the case, I will move each of these columns to the bottom of this document for simplicity of reading. It is also worth mentioning that each column in green was kept in the merged dataset while those in red were removed from the data for the reason given in the text following the column in question.**

**Each of the following terminology definitions have been found and recorded through varying combinations of NREL TMY3 description pages, NASA documents or peer-reviewed research papers. The most relevant of which have links recorded at the bottom of this document.**

**[29] "ETR (W/m^2)"**

Extraterrestrial radiation, also known as "top-of-atmosphere" irradiance, is the amount of global horizontal radiation that a location on Earth would receive if there was no atmosphere or clouds (i.e., in outer space). This number is used as the reference amount against which actual solar energy measurements are compared.

**[30] "ETRN (W/m^2)"**

Extraterrestrial radiation Normal. Same as above but at an angle normal to the recorded plane.

**[31] "GHI (W/m^2)"**

Global Horizontal Radiation — Also called Global Horizontal Irradiance; total solar radiation; the sum of Direct Normal Irradiance (DNI), Diffuse Horizontal Irradiance (DHI), and ground-reflected radiation; however, because ground-reflected radiation is usually insignificant compared to direct and diffuse, for all practical purposes global radiation is said to be the sum of direct and diffuse radiation only: GHI = DHI + DNI \* cos (Z) Where Z is the solar zenith angle.

**[34] "DNI (W/m^2)"**

See GHI. This is already a calculation included in the GHI column but may make enough of a difference on its own due to its potential to be a large part of the GHI indicator so we will keep it.

**[37] "DHI (W/m^2)"**

Keeping for same reason as DNI [34]

**[40] "GH illum (lx)"**

(Global Horizontal) Illuminance — Solar radiation in the visible region of the solar spectrum to which the human eye responds. This may or may not be necessary to keep but we will keep it for now.

**[43] "DN illum (lx)"**

(Direct Normal) Illuminance — Solar radiation in the visible region of the solar spectrum to which the human eye responds. This may or may not be necessary to keep but we will keep it for now.

**[46] "DH illum (lx)"**

(Direct Horizontal) Illuminance — Solar radiation in the visible region of the solar spectrum to which the human eye responds. This may or may not be necessary to keep but we will keep it for now.

**[49] "Zenith lum (cd/m^2)"**

Regarding luminosity at sun’s zenith. This is in candelas per square meter. This is a likely candidate to remove but we will keep it for now.

**[52] "TotCld (tenths)"**

Total Cloud Amount — The fraction of the sky dome covered by clouds. This fraction is typically expressed either as tenths (1/10, ..., 10/10) or eighths (1/8, ..., 8/8). This could prove to be a useful parameter.

**[55] "OpqCld (tenths)"**

See TotCld [52] but this deals with the portion of the sky covered with opaque clouds**.** Could also prove useful.

**[58] "Dry-bulb (C)"**

Dry-bulb Temperature — Air temperature measured with a thermometer, similar to ambient temperature. The term "dry-bulb" distinguishes it from the wet-bulb temperature measured by a psychrometer to determine relative humidity. Very useful.

**[61] "Dew-point (C)"**

Dewpoint — The temperature at which the water in the atmosphere will condense as drops on a surface. We will keep for now, but this will likely be unnecessary.

**[64] "RHum (%)"**

Relative Humidity — The amount of water vapor in the air expressed as the ratio between the measured amount and the maximum possible amount (the saturation point at which water condenses as dew). This is likely very useful.

**[67] "Pressure (mbar)"**

Atmospheric Pressure — The pressure (force per area) created by the weight of the atmosphere. At higher elevations, the atmospheric pressure is lower because there is less air (this may be mega or milli bar, but I’m inclined to say milli due to the lower-case m). This may prove completely unnecessary for our algorithm.

**[70] "Wdir (degrees)"**

Wind direction. Probably not necessary but may hold some weight in niche cases. Keep for now.

**[73] "Wspd (m/s)"**

Wind speed in meters per second. We will keep for now, but this may be a column that does not affect the resulting demand rate enough to be worth keeping.

**[76] "Hvis (m)"**

Horizontal visibility (HVIS) is a primary index used for assessing air quality. Although satellite images provide information regarding atmospheric aerosols, atmospheric visibility is not directly measured. This would be one of the first columns that I would drop but a lot of these columns may come together and build a bigger picture for our algorithm so I will leave it for now.

**[79] "CeilHgt (m)"**

In aviation, ceiling is a measurement of the height of the base of the lowest clouds (not to be confused with cloud base which has a specific definition) that cover more than half of the sky (more than 4 oktas) relative to the ground. Probably not necessary but we’ll keep for now.

**[82] "Pwat (cm)"**

Precipitable Water — The amount of water in a vertical column of atmosphere. The unit of measure is typically the depth to which the water would fill the vertical column if it were condensed to a liquid. For example, 6 centimeters of precipitable water (in the absence of clouds) indicates a very moist atmosphere. Precipitable water is often used as a synonym for water vapor. I think this is a great value to have.

**[85] "AOD (unitless)"**

Optical Depth — (Technically known as the relative aerosol optical depth) usually considered to be synonymous with the airmass, is the approximate number of aerosols in a path through the atmosphere relative to the standard number of aerosols in a vertical path through a clean, dry atmosphere at sea level. Could be useful especially in different climates.

**[88] "Alb (unitless)"**

Albedo — The fraction of solar radiation that is reflected. The solar energy community defines albedo as the fraction of solar radiation that is reflected from the ground, ground cover, and bodies of water on the surface of the earth. Astronomers and meteorologists include reflectance by clouds and air. To reduce confusion, some solar researchers use the term ground reflectance. Could be relatively useful.

**[91] "Lprecip depth (mm)"**

Level of precipitation? I’m not sure but this would make sense. Could play a role.

**[92] "Lprecip quantity (hr)"**

Unsure how this is measured but it is the same value through the whole column so we will remove it because it will not help us in predictions.

**[95] "PresWth (METAR code)"**

This has something to do with the time of observation at an airport. Given that we have the time of each value then it is unlikely that we will need this.

**\*\*\*Note\*\*\***

**See note at the top for why these columns were moved to the bottom of this page. Each of the source numbers are ambiguous and the uncertainty levels are not necessarily important to our calculations due to the uncertainty levels in our calculations caused by other factors. Each column of source and uncertainty corresponds to a column above. These corresponding columns can be found by searching a key term (not “source” or “uncert (%)” as these are named consistently throughout the document or you can search for the column number just prior to these source and uncertainty columns numerically.**

**[32] "GHI source"**

**[33] "GHI uncert (%)"**

**[35] "DNI source"**

**[36] "DNI uncert (%)"**

**[38] "DHI source"**

**[39] "DHI uncert (%)"**

**[41] "GH illum source"**

**[42] "Global illum uncert (%)"**

**[44] "DN illum source"**

**[45] "DN illum uncert (%)"**

**[47] "DH illum source"**

**[48] "DH illum uncert (%)"**

**[50] "Zenith lum source"**

**[51] "Zenith lum uncert (%)"**

**[53] "TotCld source"**

**[54] "TotCld uncert (code)"**

**[56] "OpqCld source"**

**[57] "OpqCld uncert (code)"**

**[59] "Dry-bulb source"**

**[60] "Dry-bulb uncert (code)"**

**[62] "Dew-point source"**

**[63] "Dew-point uncert (code)"**

**[65] "RHum source"**

**[66] "RHum uncert (code)"**

**[68] "Pressure source"**

**[69] "Pressure uncert (code)"**

**[71] "Wdir source"**

**[72] "Wdir uncert (code)"**

**[74] "Wspd source"**

**[75] "Wspd uncert (code)"**

**[77] "Hvis source"**

**[78] "Hvis uncert (code)"**

**[80] "CeilHgt source"**

**[81] "CeilHgt uncert (code)"**

**[83] "Pwat source"**

**[84] "Pwat uncert (code)"**

**[86] "AOD source"**

**[87] "AOD uncert (code)"**

**[89] "Alb source"**

**[90] "Alb uncert (code)"**

**[93] "Lprecip source"**

**[94] "Lprecip uncert (code)"**

**[96] "PresWth source"**

**[97] "PresWth uncert (code)"**

**Helpful Resources:**

<https://power.larc.nasa.gov/publications/SolarSpectrum2000No2.pdf>

<https://www.nrel.gov/grid/solar-resource/solar-glossary.html#e>