variable-renewable-energy-process

Collection of tools to process and interact with variable renewable energy data.

Data sources

Historical data: https://power.larc.nasa.gov/data-access-viewer/

Photovoltaic GIS map: https://globalsolaratlas.info/

Wind GIS map: https://globalwindatlas.info/

Photovoltaic

Photovoltaic Equations

1. Solar energy output

$$E = A * r * GHI * \mu$$

   where,

   E = Energy (Wh)

   A = Total solar panel area (m2)

   r = Solar panel efficiency (default value = 0.159) [1]

   GHI = Global Horizontal Irradiation (Wh / m2)

   μ = Coefficient for losses (range between 0.5 and 0.9, default value = 0.9)

2. Solar power output

$$P = E/\Delta t$$

   where,

   P = Solar panel power output (W)

   E = Energy (Wh)

   Δt = Time step (hour)

3. Solar per unit output

$$
\begin{aligned}
cf &= P/\bar{P} \\
&= \frac{A * r * GHI * \mu}{\Delta t * \bar{P}} \\
&= GHI * \frac{A * r * \mu}{\Delta t * \bar{P}} \\
&= GHI * K \\
K &= \frac{A * r * \mu}{\Delta t * \bar{P}}
\end{aligned}
$$

where,

cf = Capacity factor (p.u.)

P = Solar panel power output (W)

$\bar{P}$ = Maximum power output of the installed solar panel (Wp)

A = Total solar panel area (m2)

r = Solar panel efficiency (default value = 0.159) [1]

GHI = Global Horizontal Irradiation (Wh / m2)

μ = Coefficient for losses (range between 0.5 and 0.9, default value = 0.9)

Δt = Time step (hour)

K = Coefficient factor constant (constant parameter based on solar panel m2/Wh)

Photovoltaic Typical Value

Symbol	Value	Unit	Note
A	1.63350	m2	[1]
r	0.159	-	[1]
μ	0.90	-	-
$\bar{P}$	260	W	[1]
K	0.000899053	m2/Wh	-

Wind

Wind Equations

1.

Wind Typical Value

Symbol	Value	Unit	Note

Contributing

1. Git FIlter

   We use `nb-clean` to clean notebooks metadata.

   ```
   pip install nb-clean
   nb-clean add-filter --preserve-cell-outputs
   ```

2. Render README.md

   The README.md can be rendered using `pandoc README.md -o README.pdf`