|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Asset | KPI No. | KPIs | Short Description | Equation (may use Basic Power Calculations) |
| PV Array | 1 | Fill Factor | Measure of the quality of the solar cell, calculated at each data point. Max once a day. | PV\_Imp, PV\_Vmp : current and voltage at MPPT  Baseline: Rated power: 290kW Inverter AC Voltage=208  PV\_Voc=520V PV\_Isc=970  PV\_Imp= (a signal calculated by Typhoon based on irradiation)  PV\_Vmp= (a signal calculated by Typhoon based on irradiation)  PV\_Pmax=PV\_Imp\*PV\_Vmp Calculate PV\_FF |
| 2 | Efficiency | The ratio of the electrical power output (Pout), compared to the solar power input, Pin, into the PV cell. Pin is the solar power incident of the solar panel. For comparison of efficiency all test must be conducted at similar test condition e.g. Standard test condition with solar irradiation 1kW/m^2 and ambient temperature 25C and wind speed of 1m/s and air mass ratio of 1.5. | http://www.ni.com/cms/images/devzone/tut/adglysqn46237.gif  *PV\_A: area, PV\_S: irradiation, kw/m2*  Baseline:  = 15%-25%  PV\_A=1450V PV\_S= file\_data2 = read\_csv(SETTINGS\_DIR + "/solar\_isolation.txt")  Calculate |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Asset | KPI No. | KPIs | Short Description | Equation (may use Basic Power Calculations) |
| Power Electronics Inverter | 1 | THD Voltage | Total harmonic distortion of voltage. Calculated once at 25%, 50%, 75%, and 100%. | A close up of a logo  Description automatically generated  Baseline:  V\_THD is under 5%.  Calculate PV\_V\_THD25 when PV\_Pin =25 %  Calculate PV\_V\_THD50 when PV\_Pin =50%  Calculate PV\_V\_THD75 when PV\_Pin =75%  Calculate PV\_V\_THD100 when PV\_Pin =100% |
| 2 | Efficiency | Ratio of the usable AC output power to the sum of the DC input power ( Calculated at each data points) | PV\_ηinv =  Add PV to name of each parameter.  PV\_Va are signals. PV\_Ia are signals. Calculate PV\_ηinv |
| 3 | THD Current | Total harmonic distortion of current once at 25%, 50%, 75%, and 100%.. Calculated | Baseline:  I\_THD is under 10%.  Calculate PV\_I\_THD25 when PV\_Pin =25%  Calculate PV\_I\_THD50 when PV\_Pin =50%  Calculate PV\_I\_THD75 when PV\_Pin =75%  Calculate PV\_I\_THD100 when PV\_Pin =100% |
| 4 | Weighted Efficiency (California Energy Commission) | It can be estimated by assigning a percentage of time the inverter resides in a particular range of operation. Calculated once a day. | PV\_ηinv-10  The inverter efficiency is measured at various power levels (10%, 20%, 30%, 50%,75% and 100% of rated output AC power) and then PV\_ is calculated every day.  Calculate PV\_ηinv-10 when PV\_Pin is 10%  Calculate PV\_ηinv-20 when PV\_Pin is 20%.  Calculate PV\_ηinv-30 when PV\_Pin is 30%  Calculate PV\_ηinv-50 when PV\_Pin is 50%  Calculate PV\_ηinv-75 when PV\_Pin is 75%  Calculate PV\_ηinv-100 when PV\_Pin is 100%  Calculate: |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Asset | KPI No. | KPIs | Short Description | Equation (may use Basic Power Calculations) |
|  | 2 | Energy Efficiency | Amount of energy that is extracted as fraction of the total energy available. The efficiency for Wind turbine only can be calculated if measurements (currents and voltages) are available at the generator level. If the these parameter are not available at the generator only efficiency at wind turbine system can be calculated. | : P\_wind  : density = 1.25  A : Area = 95.8  V: velocity  Baselines:  Rated power: 50kW  AC voltage: 208V  is 30%-45%  Pw=50kW  Calculate Pout\_w  Calculate  Wind speed = velocity = file\_data = read\_csv(SETTINGS\_DIR + "/wind\_speed.txt") |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Asset | KPI No. | KPIs | Short Description | Equation (may use Basic Power Calculations) |
| Power Electronics Inverter | 1 | THD Voltage | Total harmonic distortion of voltage. Calculated once at 25%, 50%, 75%, and 100%. | A close up of a logo  Description automatically generated  Baseline:  V\_THD is under 5%.  Calculate Wd\_V\_THD25 when P\_wind =25 %  Calculate Wd \_V\_THD50 when P\_wind =50%  Calculate Wd \_V\_THD75 when P\_wind =75%  Calculate Wd \_V\_THD100 when P\_wind =100% |
| 2 | THD Current | Total harmonic distortion of current once at 25%, 50%, 75%, and 100%.. Calculated | Baseline:  I\_THD is under 10%.  Calculate wd\_I\_THD25 when P\_wind =25%  Calculate wd \_I\_THD50 when P\_wind =50%  Calculate wd \_I\_THD75 when P\_wind =75%  Calculate wd \_I\_THD100 when P\_wind =100% |
| 4 | Weighted Efficiency (California Energy Commission) | It can be estimated by assigning a percentage of time the inverter resides in a particular range of operation. Calculated once a day. | Wd\_ηinv-10  The inverter efficiency is measured at various power levels (10%, 20%, 30%, 50%,75% and 100% of rated output AC power) and then PV\_ is calculated every day.  Calculate PV\_ηinv-10 when P\_wind is 10%  Calculate PV\_ηinv-20 when P\_wind is 20%.  Calculate PV\_ηinv-30 when P\_wind is 30%  Calculate PV\_ηinv-50 when P\_wind is 50%  Calculate PV\_ηinv-75 when P\_wind is 75%  Calculate PV\_ηinv-100 when P\_wind is 100%  Calculate: |