

Performance Ratio Calculation



Huawei Technologies Co. Ltd.

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The performance ratio (PR) is stated as percent and describes the relationship between the actual and theoretical energy outputs of the PV plant.

NetEco1000S PR value calculation is using PR' $_{\rm STC}$ formula as below:

$$PR'_{STC} = \frac{\sum_{k=0}^{n} P_{out,k} \times \tau_{k}}{\sum_{k=0}^{n} \frac{(C_{k} \times P_{0}) \times G_{i,k} \times \tau_{k}}{G_{i,ref}}}$$

PR' $_{STC}$ – Performance Ratio calculated under Standard Test Conditions $P_{out,k}$ – measured power Output

 τ_k – energy recording interval time

 P_0 – rated power output

 $G_{i,k}$ – Measured value of solar irradiation intensity

G_{i,ref} – Reference value of the solar irradiation intensity

 C_k – Temperature correction factor

$$C_k = 1 + \gamma \times (T_{mod,k} - 25^{\circ}C)$$

 γ - Component peak power temperature coefficient $T_{mod,k}$ – Temperature of the PV modules

The actual PR value is calculated as follows:

$$PR = \frac{Actual \ power \ generation}{Theoretical \ power \ generation} \\ = \frac{Energy \ yield}{\sum_{k} \left(1 + \gamma \times (T_{mod,k} - 25)\right) \times P_0 \times G_{i,k}}$$

Energy Yield – Measured value of the Power Generation reported by the inverters γ – Component peak power temperature coefficient is the peak power temperature coefficient, depending on the manufacturer components



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 $T_{mod,k}$ –PV panel surface temperature: The temperature measurement by the EMI unit

 P_0 – Total string capacity: the total number of strings configured on the NetEco1000S

 $G_{i,k}$ – Solar irradiation: The radiation reported by the EMI unit Configuration steps

In order for Neteco to provide a more precise value of the PR, the following configuration steps should performed:

1. Configuration of the inverter string capacity

$$PR = \frac{Actual \ power \ generation}{Theoretical \ power \ generation} \\ = \frac{Energy \ yield}{\sum_{k} \left(1 + \gamma \times (T_{mod,k} - 25)\right) \times P_{0} \times G_{i,k}}$$

letEco	Overview Moni	itor 🛔 Historical Data Maintena	ance System	English(English) 🔻 📥 admin 🚽 🛱 🌘
	Details Alarm Device Information Adjust total energy yield	Settings 4 Grid Parameters Protect Parameters Featu	re Parameters Power Adjustment	
System 2				😔 Synchronize 🗧 S
SmartLogger	Device Description			
JINV-02	Device name	INV-01	Description	Huawei SUN2000-36KTL
INV-03	SN	21010730236TH9902462	PN	01073023
INV-04	Firmware version	V200R002C00SPC115	Protocol version	D2.2
INV-05	Rated Power	36 kW	Output mode	Three-phase, four-wire.
INV-06	Total String Capacity (Wp)	44880.0 Batch Apply 6		
INV-07	String Details Setup	5		
- INV-10	Communication Parameter			
INV-11	Device address	Device address:5.38.206.10, Device serial No.=101	Connection mode	Connection over a SmartLogger (SmartLogger)
E INV-13				

- Step 1: Select Monitor menu
- Step 2: Click on the Solar Farm on the right hand side and expand it
- Step 3: Click on one of the inverters
- Step 4: Go to "Settings"
- Step 5: Put the correct value for "Total DC power Wp"



Step 6: Click on "Batch Apply"

2. Configuration of the EMI radiation parameters

When the "Daily radiation" value reported by EMI is not accurate, the NetEco 1000S can be configured with the "Radiation Correction Factor" on the basis of the original "Daily radiation" value reported by EMI.

$$\begin{split} PR &= \frac{Actual \ power \ generation}{Theoretical \ power \ generation} \\ &= \frac{Energy \ yield}{\sum_{k} \left(1 + \gamma \times (T_{mod,k} - 25)\right) \times P_0 \times (G_{i,k} \times Radiation \ correction \ factor)} \end{split}$$

Monitor	Historical Data	Maintenance	System		admin 🔒 🕜 ❤ 📑 J 0 🛕 518 🛄 170 🧕 4
Details Alarm	Settings				
					Refresh Save
Device Description					
Device name	EMI_15_02		Description		
ESN	EM02311LNP01H6000097		Software version	V100R001C01EDI001	
Parameter Setting Radiation correction factor	1	Update PR			
Communication Param	eter				
Device address	Device IP address=212.27.5.11,E	evice serial No.=22	Connection mode	SmartLogger_15	



3. Configuration of the PR value calculation parameters

The peak power temperature coefficient can be obtained from the component parameters provided by the component manufacturer

Example of PV datasheet:

电性能参数	ALCONDA DE L'OTA						
标准测试条件下的电T 组件规格	生能參数(SIС	-)		Ylx	xxP-35b (xxx=	P.)	
峰值功率	P	w	320	315	310	305	300
功率公差	P	w	0/+5				
组件效率	η,	96	16.5	16.2	16.0	15.7	15.5
峰值功率电压	V	v	37.0	36.8	36.3	36.1	35.8
峰值功率电流	Ľ	A	8.64	8.56	8.53	8.45	8.37
开路电压	V_	v	46.0	45.7	45.6	45.4	45.2
短路电流	L	A	9.18	9.12	8.99	8.93	8.86
STC:输制度1000W/m², 200W/m²时的平均相对效。	电池温度25°C,5 奉夏减在3.3%,格	大气质量AM 建EN 6090	11.5 , 根据 EN 04-1。	60904-3,			
51C:編編度1000W/m², 200W/m²时的平均相对效 标称工作温度下的电信	电池温度25°C,7 率衰减在3.3%,相 生能参数(NC	大气质量AN 相EN 6090	11.5 , 根据 EN)4-1,	60904-3.			
SIC: 編號度 1000W/m ² , 200W/m ² 时的平均相对效 标称工作温度下的电性 峰值功率	电池温度25°C,2 率变减在3.3%,相 生能参数(NC P	大气质量AM 据EN 6090 OCT) W	11.5,根据 EN 04-1。 233.4	60904-3 . 229.8	226.1	222.5	218.8
STC: 編碼度1000W/m ² , 200W/m ² 时的平均相对效: 标称工作温度下的电性 峰值功率电压	电池温度25°C,2 率赛减在3.3%,格 生能参数(NC P _{ee} V _{ee}	大气质量AM 据EN 6099 W V	11.5,根据 EN 04-1。 233.4 33.8	229.8 33.6	226.1 33.1	222.5 32.9	218.8
SIC: 編碼度1000W/m ² , 200W/m ² 时的平均相对效/ 标称工作温度下的电付 峰值功率电压 峰值功率电流	电池温度25°C,3 率衰减在3.3%,格 <u>P</u> V L.,	大气质量AN 据EN 6090 W V A	11.5,根据EN 04-1。 233.4 33.8 6.91	229.8 33.6 6.85	226.1 33.1 6.82	222.5 32.9 6.76	218.8 32.7 6.70
51C: 編編度1000W/m ² , 200W/m ² 时的平均相对效/ 综 <u>称工作温度下的电付</u> 峰值功率电压 峰值功率电流 开路电压	电池温度25°C,3 率衰减在3.3%,格 <u>P</u> V L V	大气质量AN 閉塞EN 6091 W V A V	11.5,根据EN 233.4 33.8 6.91 42.5	229.8 33.6 6.85 42.2	226.1 33.1 6.82 42.1	222.5 32.9 6.76 41.9	218.8 32.7 6.70 41.7
STC:输卵度1000W/m ² , 200W/m ² 时的平均相对效	电池温度25°C,5 奉褒减在3.3%,将	大气质量AM 器EN 6090	11.5 , 根据 EN 04-1。	60904-3.			
:: 編編度1000W/m ² , :: 編編度1000W/m ² , <u>你工作温度下的电估</u> 直功率电压 直功率电压 百功率电压 百电流 名电压	电池温度25°C,3 率衰减在3.3%,格 生能参数(NC P V 	大气质量AM 据EN 6090 W V A V	11.5,根据EN 233.4 33.8 6.91 42.5	229.8 33.6 6.85 42.2	226.1 33.1 6.82 42.1	222.5 32.9 6.76 41.9	218.8 32.7 6.70 41.7
11C:1編加度1000W/m ² /) 00W/m ² 計的平均相対效1 50次工作温度下的电付 皆値功率电压 皆値功率电流 干路电压 路电流 IOCT:在編開度800W/m	电地温度25°C,7 率褒减在3.3%,相 生能参数(NO P V L V L ・ 、 ・ 、 ・ 、 ・ 、 ・ 、 ・ 、 ・ 、 ・ 、 ・ 、 ・ 、 ・ 、 ・ ・ ・ ・ ・ ・ ・ ・ ・ ・ ・ ・ ・	大气质量AM 掲EN 609 W V A V A 、 ス速1m/	11.5,根据EN 233.4 33.8 6.91 42.5 7.42 st的条件下组件	229.8 33.6 6.85 42.2 7.37 在开路状态下	226.1 33.1 6.82 42.1 7.27 約工作温度。	222.5 32.9 6.76 41.9 7.22	218.8 32.7 6.70 41.7 7.16
SIC: 編編度1000W/m ² , 200W/m ² #始年均用对效 修 <u>你你工作温度下的电</u> 峰值功率 峰值功率电压 峰值功率电流 开路电压 短路电流 NOCT: 在編碼度800W/m	电池量度25°C,; 率衰减在3.3%,格 生能参数(NC P	大气质量AM 開握EN 6091 W V A V A 、 人 達 1m/	11.5,根据EN 233.4 33.8 6.91 42.5 7.42 s的条件下组件	229.8 33.6 6.85 42.2 7.37 在开路状态下	226.1 33.1 6.82 42.1 7.27 的工作温度。	222.5 32.9 6.76 41.9 7.22	218.8 32.7 6.70 41.7 7.16
SIC: 編編度1000W/m ² ; 200W/m ² #始年均相対效	电地量提25°C,; 率衰减在3.3%,格 生能参数(NC P	大气质量AM 開EN 6090 W V A V A 、 人達1m/	11.5,根据EN 04-1, 233.4 33.8 6.91 42.5 7.42 st的条件下组件	229.8 33.6 6.85 42.2 7.37 在开路状态下	226.1 33.1 6.82 42.1 7.27 的工作温度。	222.5 32.9 6.76 41.9 7.22	218.8 32.7 6.70 41.7 7.16
SIC: 編編度1000W/m ² , 200W/m ² 計的平均相対效	电地温度25°C,5 率衰减在3.3%,格 生能参数(NC P _m V _m L _m V _m	大气质量AM 開EN 6094 マ マ A マ A 、 ス 連1m/	11.5 , 根据 EN 04-1, 233.4 33.8 6.91 42.5 7.42 st的条件下组件 NOCT	229.8 33.6 6.85 42.2 7.37 在开路状态下的	226.1 33.1 6.82 42.1 7.27 的工作温度。	222.5 32.9 6.76 41.9 7.22 46 +/- 2	218.8 32.7 6.70 41.7 7.16
SIC: 編編度1000W/m ² , 200W/m ² 时的平均相对效 参値功率电压 峰値功率电压 蜂値功率电压 野略电压 短路电流 NOCT: 在編照度800W/m <u>温度特性</u> 际称工作温度 峰值功率(P _{mx})的温度	电地温度25°C,5 率衰减在3.3%,核 生能参数(NC P V L V I 1 ² ,环境温度20°C	大气质量AM 棚EN 6090 W V A V A	 11.5,根据EN 04-1, 233.4 33.8 6.91 42.5 7.42 s的条件下组件 NOCT Y 	60904-3. 229.8 33.6 6.85 42.2 7.37 在开路状态下 °C 96/°C	226.1 33.1 6.82 42.1 7.27 7.27 的工作温度。	222.5 32.9 6.76 41.9 7.22 46+/-2 -0.42	218.8 32.7 6.70 41.7 7.16
SIC:編編度1000W/m ² , 200W/m ² 时的平均用对效 M在 M在 Magaza M	电池重度25°C,; 率衰减在3.3%,格 生能参数(NC P _m V _m L _m V _m L _m L n ² ,环境温度20°C	大气质量AM 開握EN 6099 マレート マレート A マレート A 、 ス速1m/	 11.5,根器EN 04-1, 233.4 33.8 6.91 42.5 7.42 s的条件下组件 NOCT γ β_{Nec} 	60904-3。 229.8 33.6 6.85 42.2 7.37 在开路状态下 °C 9%/°C	226.1 33.1 6.82 42.1 7.27 7.27 的工作温度。	222.5 32.9 6.76 41.9 7.22 46 +/- 2 -0.42 -0.32	218.8 32.7 6.70 41.7 7.16

The significance of this parameter is that if the temperature is higher than 25 C° degree Celsius, the power generation efficiency will be reduced by 0.42%



	Details Device List Alar	m Settings 3 Add Device					
					💦 Refresh 🛛 🔚 Save		
Q D	PV Plant Description						
em 🏠	PV Plant Name	Bill Sede	Description				
2 marti opper 7312	Country		City				
EMI_10873	Address	Select EMI	ony	3			
	Initialization Time	20		-			
	O Report Settings						
			Q Display EMIs of other plants				
	Parameter Setting	EMI_10873	6				
	Ratio threshold (%)			0.1200	Update Income		
	Currency	E 5		0.400			
	O Reference Value Settings O Tim	e Zon					
	Performance Ratio Configuration						
	Line loss(%)	0.		EMI_10873	Select EMI 4		
	Component peak power temperature	0					
	coefficient(%/°C)		OK Øncel				
	Availability Configuration						
	PR value range(%)	65 ~ 95	Minimum irradiance(W/mi)	50			
	Downtime rate threshold(%)	10	Update Historical Availability				
	Communitate Descentes						
	Communicate Parameter						

4. Configuration of the EMI unit

Step 1: Select Monitor menu

Step 2: Click on the Solar Farm on the right hands site

Step 3: Go to "Settings"

Step 4: Go to "Select EMI" and choose one Weather Station (please select one of the weather stations or Pyranometer if there is EMI units that do not measure irradiation value as if you select the "Mean Value" option it will take a reading from all of the EMI units and create an average data value which would be incorrect due to a wind sensor not recording irradiation data)

Step 5: Select the EMI

Step 6: If you select Display EMI's of other plants you can use other EMI installed in other plant if it is in the near area Step 7: OK