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PV CELLS TEMPERATURE INFLUENCE ON EFFICIENCY OF MONOCRYSTALINE 20 kWp PV SYSTEM

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ABSTRACT
The paper reports on the influence of PV cells temperature on the efficiency of monocrystaline 20 kWp PV system.

1. INTRODUCTION

In this time is great press on the environment protection in order the emission of the classic fossil fuels should be reduce and therefore the higher utilization of the renewable sources is expanding all over the world. The utilization of the solar radiation for the electricity production by the photovoltaic generators is one of the production way with high regardful of the environment protection. Photovoltaic technology makes use of the abundant energy in the sun, and it has little impact on our environment. Photovoltaics can be used in a wide range of products, from small consumer items to large commercial solar electric systems. The quantum efficiency of solar cells depends on many factors: temperature, insolation, spectral characteristic of sunlight etc.

2. STANDARD TEST CONDITION OF THE PV CELLS

PV modules are rated at a well- defined set of conditions known as Standard Test Conditions (STC). These conditions include the temperature of the PV cells (25 ^{o}C), the intensity of radiation (1 kW/square meter), and the spectral distribution of the light (air mass 1.5 or AM 1.5, which is the spectrum of sunlight that has been filtered by passing through 1.5 thicknesses of the earth's atmosphere). These conditions correspond to noon on a clear sunny day with the sun about 60 degrees above the horizon, the PV module directly facing the sun, and an air temperature of 0 ^{o}C. In production, PV modules are tested in a chamber known as a flash simulator. This device contains a flash bulb and filter designed to mimic sunlight as closely as possible. It is accurate within about 3.1%. Because the flash takes place in only 50 milliseconds, the cells do not heat up appreciably. This allows the electrical characteristics of the module to be measured at a single temperature, the ambient temperature of the module/factory. Since this temperature is usually close to 25 ^{o}C, a minor adjustment corrects output characteristics to the 25 ^{o}C standard temperature.

3. INFLUENCE OF PV CELLS TEMPERATURE ON THE EFFICIENCY OF MONOCRYSTALINE 20 kWp SYSTEM – SOME RESULTS

On the table 1, 2, 3, 4 are presented results of the measurements for different conditions (incidenting radiation, cells temperature).

I_{cells} [W/m^2]	454,1	453,2	461,3
I_{global} [W/m^2]	443,3	442,8	454,1
P_{DC} [W]	982,3	981,6	988,4
P_{AC} [W]	891,7	891,5	896,2
t_{cells} [°C]	12,2	12,2	12,4
η_{PV} [-]	0,1460	0,1461	0,1463
η_{total} [-]	0,1362	0,1362	0,1366

Tab.1

I_{cells} [W/m^2]	488,2	499,9	510
I_{global} [W/m^2]	531,1	540	547,6
P_{DC} [W]	1106,5	1131,9	1150,6
P_{AC} [W]	1006,9	1031,2	1049,1
t_{cells} [°C]	29,6	29,8	31
η_{PV} [-]	0,1111	0,1110	0,1106
η_{total} [-]	0,1011	0,1011	0,1008

Tab. 2

I_{cells} [W/m^2]	602,5	605,3	613,4
I_{global} [W/m^2]	620	621,4	627,6
P_{DC} [W]	1322,9	1331,2	1347,7
P_{AC} [W]	1208,4	1217,9	1229,5
t_{cells} [°C]	40,5	40,6	40,9
η_{PV} [-]	0,1076	0,1078	0,1077
η_{total} [-]	0,0983	0,0986	0,0983

Tab.3

I_{cells} [W/m^2]	975,9	981,5	960,2
I_{global} [W/m^2]	908,2	908,2	887,5
P_{DC} [W]	1929,8	1956,4	1922,6
P_{AC} [W]	1755,9	1779,1	1750,7
t_{cells} [°C]	58,4	58,9	59,1
η_{PV} [-]	0,0969	0,0977	0,0982
η_{total} [-]	0,0882	0,0889	0,0894

Tab.4

Tables 1 - 4 show total efficiency of the whole photovoltaic system on DC part and on AC part and also document almost constant efficiency of used inverters.

4. CONCLUSIONS

Except a PV panels orientation and their inclination the cells temperature has essential impact on efficiency PV systems too. The presented measurements show a range of the impact. Research was done under GACR 102/06/0132 “Renewable energy sources and their intercorporation into energy systems”.

5. REFERENCES

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