

UDC 621.3

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ENERGY EFFICIENCY AS KEY COMPONENT IN THE COMPLEX QUALITY ASSURANCE OF THE PHOTOVOLTAIC SYSTEM

The problems of energy efficiency improvement as well as electromagnetic compatibility issues are of great importance nowadays. Especially these topics become urgent within the development of the Smart Grid concept and efficiency analysis in distributed electrical networks [1]. The energy efficiency of photovoltaic systems depends on the quality of the components, influence factors to increasing efficiency:

- 1) high-efficiency solar panels,
- 2) optimization of system design,
- 3) use of tracking systems [2], [3],
- 4) keeping PV panels clean,
- 5) use of high-quality components [4], [5],
- 6) optimization of the PV panel angle and orientation [2],
- 7) use of energy storage systems [6], and
- 8) their degradation in the process of generating electricity.

Article [7] describes degradation of the main components of photovoltaic (PV) systems. The photovoltaic components life expectancies are as follow:

Solar Modules - up to 30 years; Inverters - up to 15 years for small plants; 30 years with 10% of partial replacement for every 10 years; Structure - roof-top structures - 30 years and ground mounted structures - between 30 to 60 years; Cables - 30 years.

Table 1 shows degradation of the main components of PV systems. For example, Trina Solar Company [8] produces PV panels with degradation power up to 84.8% during 25 years.

Table 1 - Important component failure rate of photovoltaic system

Photovoltaic system components	1st year degradation	Degradation between 1st and 3rd year	Degradation after 3rd year
PV panels	25%	15%	15%
Mounting structure	3%	1%	1%
Cables, Protections electrical connectors	10%	20%	30%
Inverters	55%	60%	50%
Low voltage equipment	5%	3%	3%
Energy meters	2%	1%	1%

The maximum power can be obtained using proper MPPT technique [3]. In article [9] PV panel performance parameters without tracker and with tracker were compared (Fig. 1).

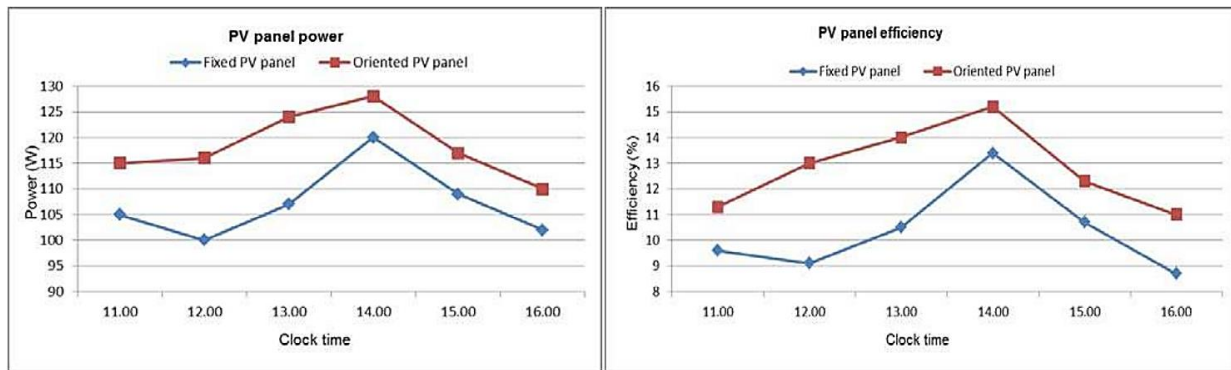


Fig. 1 – Experimental graphs of the power and efficiency dependencies for the PV systems with tracking and without [9]

Summing up, for energy efficiency of the photovoltaic systems the significant impact is made by the use of tracking systems and use of high-quality components.

This study is performed in the frame of the research project “The maximum efficiency assurance of autonomous electrical power systems for special applications based on photovoltaic converters” #0123U100975 supported by the Ministry of Education and Science of Ukraine.

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