



Power-Check 2009

PV systems with components of the
Solar-Fabrik AG

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March 2010



1 Preface

As a part of their quality control Solar-Fabrik accomplishes the „Power-Check“. Owners of photovoltaic systems with modules and inverters from Solar-Fabrik were asked for the energy production of their systems in the years 2005 to 2008. To get a resilient data base it was asked for the invoice of the energy production from the local electricity supplier. Fraunhofer ISE was contracted for the evaluation of this data. The following analysis is based on 115 PV-systems which had been build in the years 1999 to 2007.

To evaluate the quality of a PV-system the Performance Ratio (PR) is used. The Performance Ratio is the ratio of the energy which has been produced compared to the energy which would have been produced by the solar modules at 25°C in an optimal system free of losses. To calculate the Performance Ratio the locations of the systems were divided into five areas. For each area the irradiation data of a reference location provided by the Deutscher Wetterdienst (DWD) was used.

2 Results

System yield

The average yield of the observed PV-systems amounts to almost 1000 kWh per kWp. In the table below the annual mean values are listed. The very high yields are caused by the high irradiation levels during the recent years and also by the improved system performance.

year	systems	average yield [kWh/kWp]	Average Performance Ratio [%]
2005	49	975	74,9
2006	59	958	74,7
2007	89	999	75,8
2008	103	982	77,2

The bar graph in figure 1 shows an accumulation of yield values between 950 up to 1050 kWh/kWp. Two thirds of the systems reached more than 900

kWh/kWp. The best systems have outperformed 1100 kWh/kWp in all four years.

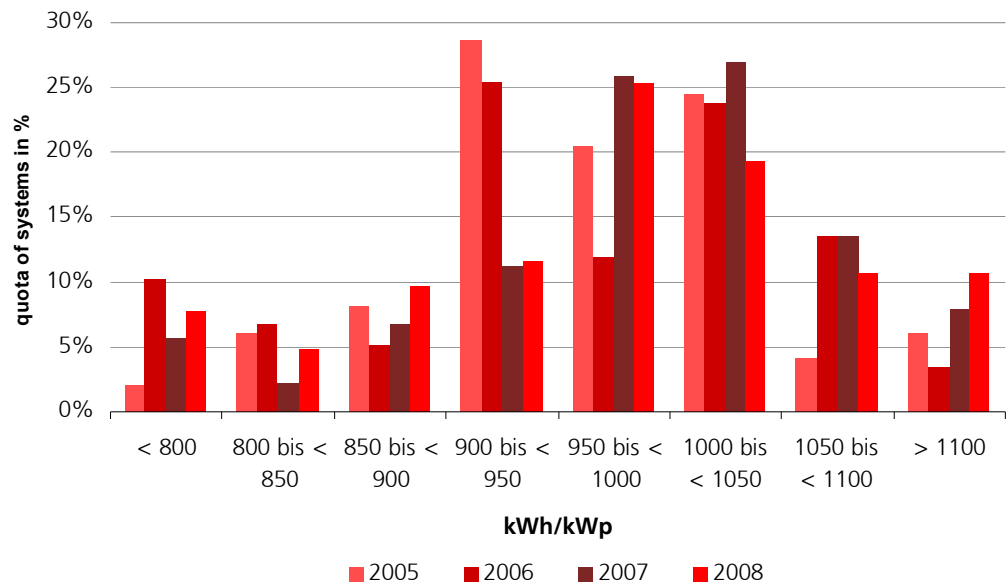


Figure 1: yield distribution of all systems for the years 2005 to 2008

Performance Ratio

The average Performance Ratio of the investigated PV-systems was around 76%. The distribution in figure 2 shows the Performance Ratio of all four years. Because of the newer systems in the examined years, the distribution of the more recent years shifts to higher values of the Performance Ratio. Only a few systems do not reach the 75 % value. The best systems have exceeded the 85 % mark and are accomplishing the value of large solar power stations.

Figure 3 compares the PV-systems from Power-Check to PV-systems being monitored by Fraunhofer ISE. The PV-systems with components from the Solar-Fabrik are widespread in the total entity of systems. It is planned to make on-site checks at some selected PV-systems with a Performance Ratio less than 65%.

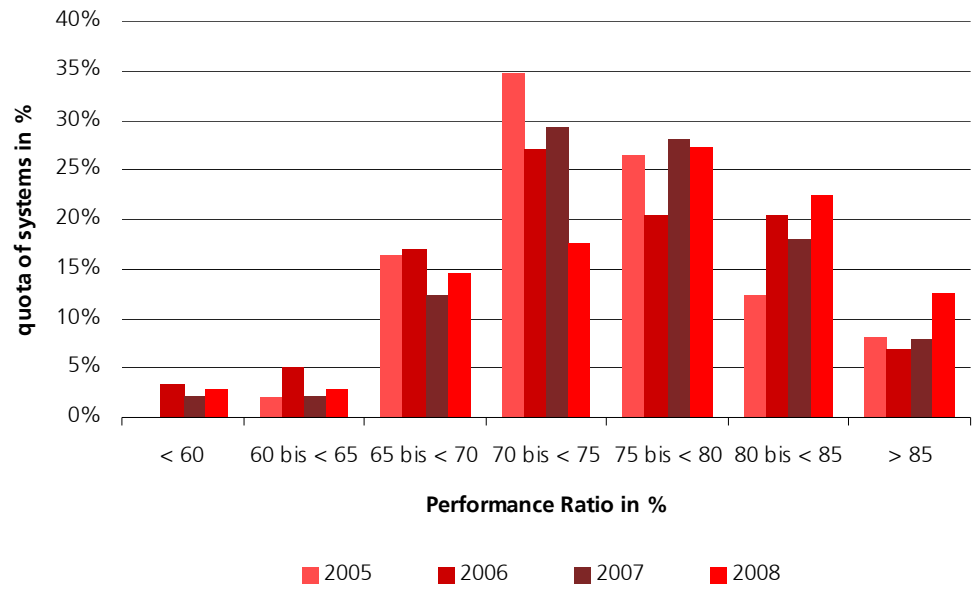


Figure 2: Distribution of the Performance Ratio for the years 2005-2008

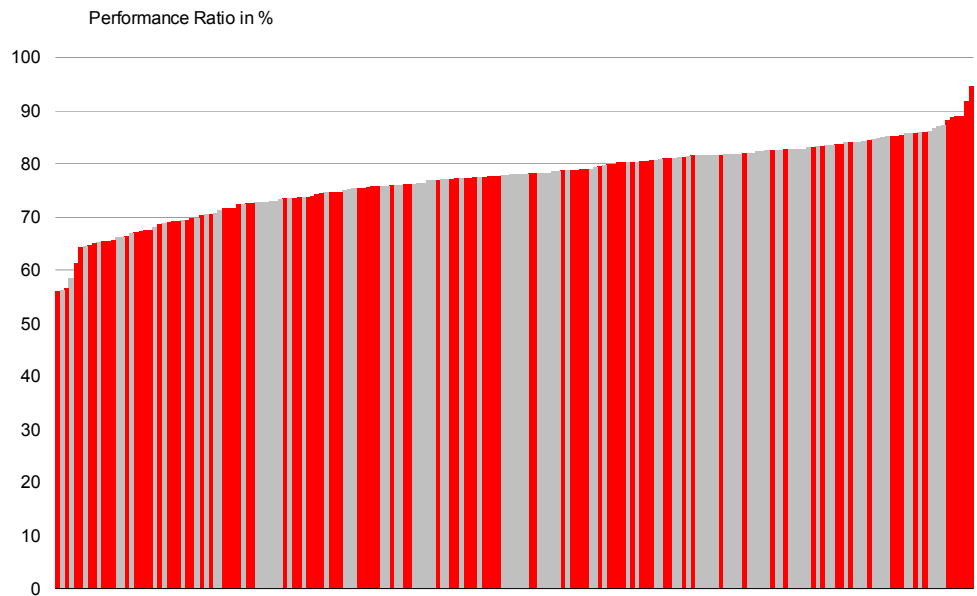


Figure 3: 100 PV-systems in South-Germany from Fraunhofer ISE Monitoring (grey) compared to the PV-systems from Power-Check (red) .

3 Assessment

The Power-Check shows, that PV-systems with components from the Solar-Fabrik are state of the art and achieve very good results. Such results are only possible with modules and inverters of high quality. Also an appropriate system design and a professional installation is required for a nearly failure-free operation. This research for the Solar-Fabrik is done for to quality control and for giving feedback from practice.

4 Glossary

Yield:

The electrical Energy, measured in kilo watt hours (kWh), which is fed into the grid, is measured by gauged counters from the local electric supplier. If you divide the yearly production by the nominal power (maximum power of the generator in kWp) of the system, you get the yield in kWh/kWp. This value strongly depends on precise power labelling of the modules by the manufacturer.

Performance Ratio (PR):

$PR = \text{yearly energy production} / (\text{yearly irradiation on the module surface} \cdot \text{efficiency of the module at „Standard Test Conditions“})$. The Performance Ratio is a degree of system quality largely independent of the system location. Only very good systems reach values higher than 85%.