



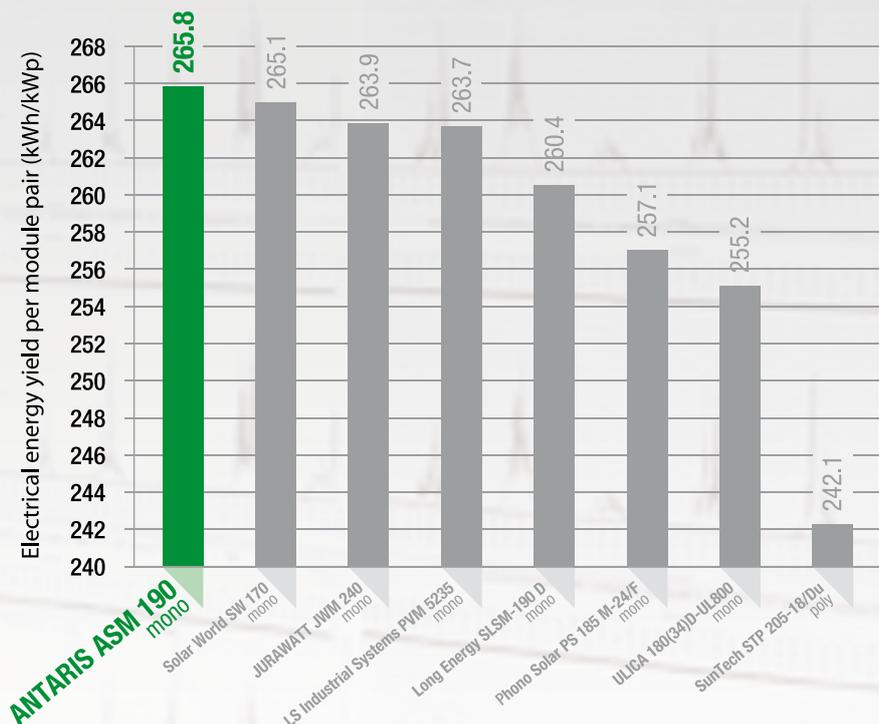
Comparative test for photovoltaic modules Test winner: ANTARIS SOLAR

ANTARIS AS M 190 – The module with the highest energy output

In the photovoltaic market, the range of products and services on offer from a wide variety of module vendors is booming. To keep track and separate the wheat from the chaff, you need the relevant information. Just as in the summer of 2010, the TEC Institute has again tested eight modules from reputable photovoltaic system manufacturers, this time during the three autumn months of 2011, in order to investigate the performance of the individual modules in low light. At that time of year, the sun is already low and global radiation is much weaker than in the summer. The test was once again conducted under real conditions on the roof because a laboratory test under artificial lighting conditions would be of only limited value in attempting to establish an objective verdict. The basic

requirements for a realistic measurement were met: the TEC Institute runs its own weather station with temperature, air pressure, wind, rain and humidity sensing as well as a pyranometer for measuring global radiation (the total amount of sunlight or solar radiation that reaches the earth's surface within a horizontal "reception area"). Hence the weather situations in the test phase could be precisely recorded parallel to the detected yield values, making it possible to reach an objective verdict about the real energy output of the various modules. In the comparative test, the ANTARIS AS M 190 scored the top mark of 1.1 with respect to the highest energy output per individual module and therefore emerged as the winner.

Test system, electrical energy delivered per module type
from 01.09.2011 to 30.11.2011



TEST WINNER
 TESTED: 8 PV MODULES
 5 Very good, 2 Good,
 1 Satisfactory
 02/2012
ANTARIS AS M 190
VERY GOOD

Results of the series of tests on PV modules to determine the highest energy output for each module

Provider and product	Cell type	Nominal power (Wp)*	Measured energy output according to the series of tests conducted by the TEC Institute, per individual module (kWh/kWp)**	Verdict
ANTARIS ASM 190	monocrystalline	190	265.8	1.1 very good
Solar World SW 170	monocrystalline	170	265.1	1.1 very good
JURAWATT JWM 240	monocrystalline	240	263.9	1.2 very good
LS Industrial Systems PVM S235	monocrystalline	235	263.7	1.2 very good
Long Energy SLSM-190 D	monocrystalline	190	260.4	1.5 very good
Phono Solar PS 185 M-24/F	monocrystalline	185	257.1	1.9 good
ULICA 180(34)D-UL800	monocrystalline	180	255.2	2.2 good
SunTech STP-18/DU	polycrystalline	205	242.1	3.3 satisfactory

* According to manufacturer data (printed directly on the respective module) and STC

ANTARIS AS M 190: The module with the highest energy output



Measurements were carried out on the eight modules from various reputable manufacturers over the autumn months during the period from 01.09.2011 to 30.11.2011. All module types were wired up in separate strings of either two or three modules of the same type depending on the level of the module voltage and the MPP voltage of the inverter. Each string fed into the electricity grid via its own "Mastervolt Soladin 600" inverter. The voltage and current were recorded for the modules. Measuring cycle: 1 minute. These measurements were used to calculate the DC power and the electrical energy supplied by the modules. With respect to the alternating current, one feed meter per module pair recorded the power they fed into the electricity grid. During the test, all modules were free of shadows and were aligned precisely to the south and tilted at an angle of 30 degrees. Another important criteria was that, as far as was possible, the cable length had to be exactly same for all the test strings. As already mentioned, the working ranges of all strings were within the MPP range of the inverter. Once again this year, none of the modules tested achieved the 100% performance mark, 1 was getting there, 2 were close and only 5 were very close.

The ASM 190 module from ANTARIS SOLAR with a monocrystalline type of cell yielded an energy output of 265.8 kWh/kWp (this equates to 99.5 % of the anticipated energy output of 100%). You can view the comparison with the competing modules from 4 other manufacturers that also received the top rating of "very good", but just failed to match the energy output of the ANTARIS SOLAR ASM 190, in the diagram on the front