

## PHOTON Lab's outdoor module tests: Results of 2013 yield measurements

2013 rank	Manufacturer	Model	Performance ratio (%) January - December 2013	Yield (kWh/kW) January - December 2013	Deviation from test winner (%)	Cell type	Origin	Production dates <sup>21</sup>	Installed in	STC power (W)	2012 rank
1	Sopray Energy	SR-190	94.0	1094.3	—	Mono	—	—	1/2013	190.8	—
2	Risen Energy	SYP190S-M	93.8	1092.5	0.16 %	Mono	CN	—	10/2012	188.9	—
3	ET Solar Industry	ET-M660250WW	93.4	1088.0	0.58 %	Mono	CN	—	12/2012	248.9	—
4	Hanwha Q-Cells	Q.PRO-G2 235	93.3	1086.9	0.68 %	Multi	PL	—	11/2012	236.9	—
5	Sonalis	SL190TU-36M	93.3	1086.5	0.71 %	Mono	CN	—	8/2012	196.6	—
6	Risen Energy	SYP250M	93.1	1084.3	0.91 %	Mono	CN	—	7/2012	243.7	—
7	CSG PVTech	CSG240M2	93.1	1084.0	0.94 %	Multi	—	—	1/2013	242.8	—
8	Renesola	JC245M-24/Bbv	93.1	1083.6	0.98 %	Quasi-mono	—	—	10/2012	246.6	—
9	Sopray Energy	SR-156P-235	93.0	1083.3	1.01 %	Multi	—	—	1/2013	235.6	—
10	CSG PVTech	CSG250S2	93.0	1083.2	1.01 %	Mono	—	—	1/2013	250.1	—
11	RealForce Power	RF-240P60	92.8	1081.1	1.21 %	Multi	CN	—	1/2013	241.9	—
12	Seraphim Solar System	SRP-220-6PB	92.6	1078.4	1.45 %	Multi	CN	—	10/2011	226.1	4
13	Jinko Solar	JKM190M-72	92.6	1078.3	1.46 %	Mono	—	2010	7/2011	191.1	9
14	Jinko Solar	JKM275P	92.6	1078.3	1.46 %	Multi	—	—	4/2012	275.5	—
15	Siliken	SLK60P6L 230Wp	92.4	1075.5	1.72 %	Multi	ES	—	2009	229.7	8
16	ET Solar Industry	ET-P660240	92.2	1073.5	1.90 %	Multi	CN	—	7/2011	236.1	6
17	JA Solar Technology	JAM6-60-250/SI	92.1	1072.6	1.98 %	Mono	—	—	1/2013	253.1	—
18	REC	Premium 210	92.1	1072.4	2.00 %	Multi	SE	Through 2008	2/2011	212.2	26
19	CSG PV Tech	CSG180S1-35/36	92.1	1072.0	2.04 %	Mono	CN	2008	6/2010	184.1	13
20	Hareon Solar Technology	HR-230P-18/Bb	92.1	1072.0	2.04 %	Multi	—	—	7/2011	230.6	31
21	Solon	SOLON Blue 230/07(225)	92.0	1071.6	2.07 %	Multi	DE	2008	2/2011	226.9	36
22	Sunlink PV	SL220-20M230	92.0	1071.4	2.09 %	Mono	CN	—	2/2011	237.9	44
23	Linsun Renewable Energy	SK60P6	92.0	1071.1	2.12 %	Multi	—	—	7/2011	228.3	15
24	Phono Solar	PS190M-24/F	92.0	1071.0	2.13 %	Mono	CN	—	5/2012	192.0	—
25	Linuo PV High-Tech	LN240(30)P-3-240	91.9	1070.5	2.17 %	Multi	—	—	1/2013	239.5	—
26	CNPV Solar Power	CNPV-220P	91.8	1069.0	2.31 %	Multi	CN	2006	7/2011	224.2	43
27	Upsolar	UP-M220P	91.8	1068.9	2.32 %	Multi	CN	2010-2011	2/2011	219.2	21
28	Kinmac Solar	KSS-6P6A-230	91.7	1068.2	2.39 %	Multi	TW	2010	2/2011	234.1	33
29	Sunerg Solar	XP 60/156-230	91.7	1067.8	2.42 %	Multi	IT	—	2/2011	226.0	7
30	Renesola	JC245M-24/Bb	91.7	1067.4	2.46 %	Multi	—	—	10/2012	247.7	—
31	REC	REC230AE	91.6	1066.2	2.57 %	Multi	SE	2007/2010	2/2010	228.6	27
32	CSG PV Tech	CSG230M2-30	91.5	1066.0	2.59 %	Multi	CN	2008	6/2010	228.3	67
33	Runda PV	RS230P-60	91.5	1065.0	2.68 %	Multi	CN	—	1/2012	237.8	91
34	Solar Modules Nederland	TC245-MO	91.4	1064.1	2.76 %	Mono	NL	2010-2011	2/2011	246.7	32
35	V-Energy	VE260PV	91.4	1064.1	2.76 %	Multi	IT	—	1/2012	234.6	30
36	Win Win Precision Technology	Winaico WSP-230P6	91.4	1064.0	2.77 %	Multi	TW	2009	2009	234.4	121
37	SolarWorld	Sunmodule Plus SW 225 mono	91.3	1063.3	2.83 %	Mono	US	2009	3/2010	233.4	20
38	Aleo Solar	Aleo S_18 225	91.3	1062.6	2.90 %	Multi	DE, ES	2005	4/2010	230.5	22
39	Nesl Solartech	DJ-235P	91.2	1062.0	2.95 %	Multi	CN	—	5/2012	237.7	—
40	CH Solar	CH Solar 180 mono	91.2	1061.5	3.00 %	Mono	CN	Through 2010	4/2010	184.4	45
41	Phono Solar	PS230P-20/U	91.1	1061.1	3.03 %	Multi	CN	—	5/2012	235.8	—
42	Lightway Green New Energy	LW235(29)P1650*990	91.1	1060.7	3.07 %	Multi	CN	—	4/2012	235.7	—
43	Ningbo Solar Electric Power	Sun Earth TDB125x125-72-P 180W	91.1	1060.5	3.09 %	Mono	CN	Through 2010	2/2011	179.2	70
44	Topray Solar	TPS105T-180W	91.0	1060.0	3.13 %	Mono	CN	—	5/2011	184.8	82
45	Eoply New Energy Technology	EPS125M/72-190W	91.0	1059.9	3.14 %	Mono	CN	—	1/2013	187.3	—
46	Sungen	SGM-235P	90.9	1059.0	3.23 %	Multi	CN	—	5/2012	235.4	—
47	Huanghe Photovoltaic Technology	HH190(36)M	90.9	1058.1	3.31 %	Mono	CN	—	1/2012	190.9	16
48	Linuo Group	LN240(30)P-225	90.9	1058.0	3.32 %	Multi	—	2003	7/2011	236.5	76
49	Solar-Fabrik	Premium L poly (225)	90.9	1058.0	3.32 %	Multi	DE	—	2/2011	223.6	123
50	S-Energy	SM-220PA8	90.9	1057.9	3.33 %	Multi	KR	—	2009	224.4	77
51	BP Solar International	BP 3220 T	90.8	1057.8	3.34 %	Multi	CN	Through 2011	7/2011	232.5	35
52	Zentralsolar Deutschland	Genius SDM 185-10004-185	90.8	1057.7	3.34 %	Mono	—	—	7/2011	190.6	80
53	REC	REC230PE	90.8	1057.1	3.40 %	Multi	SG	2010	2/2011	237.6	41
54	JCS Solar	JCSM290M-72	90.8	1057.0	3.41 %	Mono	—	—	1/2012	296.9	60
55	Chaoi Solar Energy	CRM240S156P-60	90.7	1056.6	3.45 %	Multi	—	—	5/2012	241.0	—
56	Qixin Solar Electrical Appliance	SL250CE-48M	90.7	1056.6	3.45 %	Mono	—	—	4/2012	255.9	—
57	NexPower Technology	NT-125AX	90.7	1056.4	3.46 %	µc-Si / a-Si	TW	2009-2010	11/2010	125.4	14
58	Mage Solar	Mage Powertec Plus 230/6PH-US	90.7	1056.2	3.48 %	Multi	US	—	7/2011	231.8	72
59	Axitec	AC 236P/156-60S	90.7	1055.7	3.53 %	Multi	DE	Through 2011	2/2011	232.9	64
60	Chaoi Solar Energy	CRM245S156M-60	90.7	1055.7	3.53 %	Mono	—	—	5/2012	246.3	—



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61	China Sunergy	CSUN260-60M	90.7	1055.6	3.54 %	Mono	CN		–	1/2012	254.0	46
62	SWAT-International	SWAT-240-PS	90.6	1055.4	3.55 %	Multi	–		–	5/2011	245.1	54
63	Sunflower	SF125x125-72-M(180)	90.6	1055.3	3.56 %	Mono	CN		–	2/2011	176.6	51
64	REC	REC245PE	90.6	1055.0	3.59 %	Multi	SG		–	1/2013	243.1	–
65	Solarwatt	M220-60 GET AK (230)	90.6	1054.8	3.61 %	Mono	DE		2005	2/2011	231.5	86
66	Sunage	SAM 96/5	90.5	1054.3	3.66 %	Mono	CH		–	7/2011	256.6	106
67	Bosch Solar Energy	Bosch c-Si M 60 230	90.5	1053.5	3.73 %	Mono	DE	2009–2010	2/2011	233.2	78	
68	China Sunergy	CSUN250-60M	90.5	1053.5	3.73 %	Mono	CN		–	1/2012	248.4	58
69	Luxor Solar Technologies	LX-250M/156-60+	90.5	1053.4	3.74 %	Mono	–		–	1/2013	247.5	–
70	Jinko Solar	JKM235P-60	90.5	1053.3	3.75 %	Multi	–		–	1/2012	231.4	11
71	Eopilly New Energy Technology	EPS156P/60-235W	90.4	1052.7	3.80 %	Multi	CN		–	1/2013	237.8	–
72	Chint Solar / Astronergy	CHSM 6610P (230)	90.4	1052.4	3.83 %	Multi	–		–	1/2012	234.2	108
73	Jetion Solar	JT230(30)P1655x992	90.4	1052.2	3.85 %	Mono	CN	2005	2/2011	232.4	112	
74	Win Win Precision Technology	Winaico WSP-235P6	90.4	1052.1	3.86 %	Multi	TW		–	5/2010	240.1	40
75	SolarWorld	Sunmodule Plus SW 225 poly	90.3	1051.4	3.92 %	Multi	DE	2004–2011	2/2011	228.6	65	
76	BP Solar International	BP 3280 T	90.3	1051.2	3.94 %	Multi	–	Through 2011	5/2011	287.4	83	
77	Galaxy Energy	GS260m-96	90.3	1051.2	3.94 %	Mono	DE		–	2/2011	252.9	61
78	CNPV Solar Power	CNPV-185M	90.3	1051.1	3.95 %	Mono	CN	2006	3/2010	193.8	48	
79	Trina Solar	TSM-180DC01	90.3	1051.0	3.96 %	Mono	CN	2007	2009	176.2	68	
80	SolarWorld	SW 245 poly	90.2	1050.9	3.97 %	Multi	DE		–	1/2012	245.3	38
81	Amerisolar, Worldwide Energy & Manufacturing	AS-6P30-230W	90.2	1050.2	4.03 %	Multi	–		–	1/2012	236.8	47
82	BYD	BYD 240P6-30	90.1	1049.6	4.08 %	Multi	CN		–	9/2012	243.6	–
83	CEEG Solar Science & Technology	SST 240-60M	90.1	1049.0	4.14 %	Mono	CN	2005	2/2011	239.0	57	
84	Kioto Photovoltaics	KPV 210 PE	90.1	1048.9	4.15 %	Multi	AT	2008–2010	2009	206.6	34	
85	Schott Solar	SCHOTT PERFORM Poly 235	90.1	1048.8	4.16 %	Multi	CZ	Since 2011	1/2012	239.0	18	
86	Sonalis	SL-180CE-36M	90.1	1048.8	4.16 %	Mono	CN		–	3/2010	185.1	103
87	Conergy	Conergy PowerPlus 220P	90.0	1048.5	4.19 %	Multi	DE	2009	3/2010	224.2	56	
88	Bisol	BMU-215-2/233	90.0	1048.0	4.23 %	Multi	SI	2009	2/2011	234.2	55	
89	CEEG Solar Science & Technology	SST 265-72P	90.0	1047.9	4.24 %	Multi	CN	2005	2/2011	281.0	63	
90	Upsolar	UP-M180M	90.0	1047.8	4.25 %	Mono	CN	2010–2011	3/2010	181.5	49	
91	Trina Solar	TSM-225PC05	89.9	1046.8	4.34 %	Multi	CN		–	2/2010	233.0	69
92	Amerisolar, Worldwide Energy & Manufacturing	AS-5M-190W	89.9	1046.7	4.35 %	Mono	–		–	1/2012	195.0	39
93	Trina Solar	TSM-250PC05	89.9	1046.7	4.35 %	Multi	–		–	6/2012	249.3	–
94	Mage Solar	Mage Powertec Plus 230/6PO	89.9	1046.3	4.39 %	Multi	CN		–	2/2011	229.9	–
95	CNPV Solar Power	CNPV-190M	89.8	1045.7	4.44 %	Mono	CN	2006	7/2011	197.4	114	
96	IBC Solar	IBC MonoSol 240 TT	89.8	1045.5	4.46 %	Mono	DE	Through 2011	2/2011	246.0	134	
97	Solaria Energía y Medio Ambiente	S6P2G225	89.7	1044.6	4.54 %	Multi	ES	2010	5/2011	232.7	66	
98	Eurener	PEPV230	89.6	1043.8	4.61 %	Multi	ES		–	1/2012	235.3	42
99	Kenmec Mechanical Engineering	TKSA-23001	89.6	1043.4	4.65 %	Multi	TW		–	7/2011	235.0	89
100	Solargate Technology	SG-2350	89.6	1043.2	4.67 %	Multi	TW		–	1/2012	246.3	99
101	Mage Solar	Mage Powertec Plus 225/6PJ	89.6	1042.8	4.71 %	Multi	CN	Through 2011	2009	232.0	62	
102	Solarbest Energy-Tech	ZSB M190	89.5	1042.7	4.72 %	Mono	CN		–	12/2011	186.1	87
103	Lilie Energie	Lilie SPL 185	89.5	1042.5	4.73 %	Mono	–		–	2/2011	185.3	96
104	Talesun Solar	TP572M-195	89.5	1042.2	4.76 %	Mono	CN	2011	1/2012	196.1	85	
105	Eging Photovoltaic Technology	EGM-185	89.5	1042.1	4.77 %	Mono	CN	2010	2/2011	188.4	75	
106	Yingli Green Energy Holding	YL210P-29b	89.5	1041.9	4.79 %	Multi	CN	2009	2/2011	214.3	95	
107	Win Win Precision Technology	Winaico WSP-240P6	89.4	1041.5	4.83 %	Multi	–		–	4/2012	245.2	–
108	Bisol	BMU-215-2/221	89.4	1041.4	4.83 %	Multi	SI	2007	2/2010	229.1	84	
109	Sungen	SGM-195D	89.4	1041.4	4.83 %	Mono	CN		–	5/2012	196.5	–
110	Frankfurt Solar	FS215W-POLY	89.4	1041.3	4.84 %	Multi	CN		–	2009	221.3	79
111	Axitec	AC-250M/156-60S	89.3	1039.8	4.98 %	Mono	CN, EU		–	1/2012	248.9	118
112	Ningbo Solar Electric Power	Sun Earth TDB125x125-72-P 160W	89.2	1039.2	5.04 %	Mono	CN		–	2/2011	161.6	107
113	Aide Solar Energy Technology	AD195M5-Aa	89.2	1038.9	5.06 %	Mono	CN		–	9/2011	198.0	115
114	Suntech Power	STP205-18/Ud	89.1	1037.3	5.21 %	Multi	CN		–	2/2011	213.8	92
115	Lilie Energie	Lilie SPL 185-I	89.0	1036.6	5.27 %	Mono	–		–	2/2011	187.1	119
116	Zytech Engineering	ZT 230P	89.0	1036.4	5.29 %	Multi	CN		–	2/2011	230.8	98
117	PV Power Technologies	PVQ3 220	89.0	1036.1	5.32 %	Multi	IN	2008	2009	223.6	53	
118	Sunrise Solartech	SRM 180D72-GE	89.0	1036.0	5.33 %	Mono	CN		–	2009	181.5	94
119	China Sunergy	CSUN240-60P	88.9	1035.6	5.36 %	Multi	CN		–	1/2012	243.7	105
120	Shinsung	SS-BM260C	88.9	1035.5	5.37 %	Mono	KR		–	4/2012	258.8	–



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121	Perfectenergy	PEM-180/185-72M-SCC	88.5	1030.9	5.79 %	Mono	CN	2008	6/2010	191.3	127
122	CNPV Solar Power	CNPV-240M	88.3	1027.8	6.08 %	Mono	CN	2006	7/2011	249.7	102
123	Kyocera	KD210GH-2PU	88.2	1026.9	6.16 %	Multi	EU	2009	2/2011	212.1	129
124	Isototon	ISF-255	87.9	1023.9	6.43 %	Mono	ES	2012	4/2012	255.0	-
125	Schott Solar	SCHOTT POLY TM 220	87.5	1019.3	6.85 %	Multi	CZ	2008-2009	2/2011	224.7	133
126	Calrays	CPM 250-A-96	87.5	1019.0	6.88 %	Mono	-	-	7/2011	244.0	137
127	Sharp	NU-185E1	87.4	1017.6	7.01 %	Mono	GB	2005	3/2011	186.1	125
128	Scheuten Solar	Multisol P6-60	87.4	1017.3	7.04 %	Multi	DE	-	6/2011	238.1	104
129	Evergreen Solar	ES-A-210-fa2	87.2	1015.9	7.16 %	Ribbon	US	2008	3/2011	210.0	126
130	Shell Solar (now with Solarworld)	Shell SQ 150-C	87.0	1013.1	7.42 %	Mono	PT	Through 2005	2006	155.8 <sup>*3</sup>	122
131	Sovello	SV-X-205-fa1	86.8	1010.4	7.67 %	Ribbon	DE	-	2/2011	206.1	136
132	SolarWorld	Sunmodule Plus SW 210 poly	86.8	1010.2	7.69 %	Multi	DE	2004	2006	212.2 <sup>*3</sup>	97
133	First Solar	FS-265	86.7	1010.0	7.70 %	CdTe	US	2006-2011	2007	65.4 <sup>*3</sup>	131
134	Emmvee Photovoltaics	ES-230P60	86.6	1008.0	7.89 %	Multi	IN	2008-2011	3/2010	234.0	132
135	Shell Solar	Shell PowerMax Eclipse 80-C	86.5	1007.3	7.95 %	CIS	US	2005-2006	2007	90.8 <sup>*3</sup>	-
136	Day4 Energy	Day4 48MC 185	86.1	1003.1	8.33 %	Multi	CA	2006	2/2011	186.5	124
137	Sovello	SV-X-200-fa1	85.5	995.2	9.06 %	Ribbon	DE	2009-2011	1/2011	205.0	140
138	Solar-Fabrik	SF 130/4-130	85.4	994.6	9.11 %	Mono	DE	2006-2010	3/2010	130.7	138
139	Suntech Power	STP190-18/Ub	85.3	993.2	9.24 %	Multi	CN	2005	2/2011	182.9	135
140	Solar-Fabrik	SF 145A	84.2	980.3	10.42 %	Ribbon	DE	2003-2004	2005	145.8 <sup>*3</sup>	143
141	Hanwha SolarOne	SF160 M5-24 (175 W)	83.7	974.7	10.93 %	Mono	CN	-	2007	174.6 <sup>*3</sup>	128
142	Canadian Solar	CS6A-170P	83.3	969.9	11.37 %	Multi	CN	2007 (purchased)	2007	174.4 <sup>*3</sup>	141
143	Sunways	MHH plus 190 (190 Wp)	83.3	969.4	11.41 %	Multi	DE	2003-2005	2005	199.5 <sup>*3</sup>	142
144	Isototon	IS-170/24	82.9	964.8	11.83 %	Mono	ES	2007	2009	172.8	144
145	Kyocera	KC170GT-2	82.8	964.0	11.91 %	Multi	JP	Through 2006	2006	178.4 <sup>*3</sup>	146
146	Isototon	I-110/24	81.3	947.2	13.44 %	Mono	ES	Through 2005	2006	102.5 <sup>*3</sup>	145
147	BP Solar International	BP 7185 S	81.1	944.0	13.73 %	Mono	ES, IN	-	2005	185.1 <sup>*3</sup>	148
148	Photowatt International	PW 1650-175W	80.6	938.4	14.25 %	Multi	FR	2005 (purchased)	2006	171.4 <sup>*3</sup>	149
149	Sharp	NT-R5E3E	79.8	928.7	15.13 %	Mono	JP	2003	2005	187.9 <sup>*3</sup>	151
150	Evergreen Solar	ES-180-RL	76.6	892.3	18.46 %	Ribbon	DE	2006-2008	2007	185.4 <sup>*3</sup>	150
	Alex Solar Energy & Technology	ALM-190D-24	*2	*2	*2	Mono	CN	2009	7/2011	187.8	113
	ASE (now with Schott Solar)	ASE-300-DG-FT (300 W)	*2	*2	*2	Ribbon	US	1997-2006	2007	308.1 <sup>*3</sup>	147
	CNPV Solar Power	CNPV-240P	*2	*2	*2	Multi	CN	2006	7/2011	243.1	24
	Conergy	PowerPlus 235P	*2	*2	*2	Multi	DE	-	1/2012	240.0	19
	Evergreen Solar	ES-E-210-fc3	*2	*2	*2	Ribbon	US	-	2/2011	211.2	120
	Fluitemik	FTS-220 P	*2	*2	*2	Multi	PT	-	11/2011	231.8	90
	Hanwha SolarOne	SF160-24-1M175 (scac)	*2	*2	*2	Mono	CN	-	2/2010	183.0	81
	Hengdian Group Dmegc	DM190-M125-72	*2	*2	*2	Mono	CN	-	4/2012	196.6	-
	Huanghe Photovoltaic Technology	HH230(30)P	*2	*2	*2	Multi	CN	-	1/2012	231.7	10
	JA Solar Technology	JAP6-60-240/3BB	*2	*2	*2	Multi	-	-	1/2013	242.1	-
	Latitude Solar	Latitude P6-60/6 (235)	*2	*2	*2	Multi	SE	-	1/2012	241.2	-
	Linuo Group	LN180(36)M-185	*2	*2	*2	Mono	-	2003	7/2011	191.8	59
	Magi Solar Energy Technology	MGSM-240D-60	*2	*2	*2	Mono	CN	-	7/2011	246.1	93
	M-Prime	M 235P	*2	*2	*2	Multi	PT	-	1/2012	240.7	50
	Nelumbo	NEI 230-3VA	*2	*2	*2	Multi	CZ	-	2/2011	228.5	17
	Qixin Solar Electrical Appliance	SL230CE-30P	*2	*2	*2	Multi	-	-	4/2012	239.6	-
	Risen Energy	SY185S-M	*2	*2	*2	Mono	CN	-	7/2011	191.7	52
	Solibro	SLI-95	*2	*2	*2	CIGS	DE	2008	2/2011	97.3	-
	Sonalis	SL-190CE-36M	*2	*2	*2	Mono	-	-	1/2012	188.9	130
	Sunpeak / AlpeSolar	ALP235W	*2	*2	*2	Mono	IN	2009-2010	3/2010	233.0	111
	SunPower	SPR-245NE-WHT-D	*2	*2	*2	Mono	-	-	1/2012	245.2	3
	SunPower	SPR-320NE-WHT-D	*2	*2	*2	Mono	-	-	1/2012	325.5	2
	SunPower	SPR-327NE-WHT-D	*2	*2	*2	Mono	-	-	1/2012	325.8	1
	Topsolar Green	TSM72-125M-190W	*2	*2	*2	Mono	CN	-	7/2011	185.9	100
	Topsolar Green	TSM96-125M-250W	*2	*2	*2	Mono	CN	-	3/2012	246.6	-
	Upsolar	UP-M185M	*2	*2	*2	Mono	CN	2010-2011	2/2011	189.2	101

\*1 when the date of production was unavailable, the date when the PHOTON Lab bought the module was used (if possible)

\*2 no data available

\*3 STC power specification was not determined by PHOTON Lab but by the manufacturer

