

UNITED SOLAR OVONIC – Short Summary of Most Recent Monitoring Results

Overview

1. Installation in the Rhön Region, Germany
2. Installation in Bolzano, Italy
3. Installation at Santa Cruz Test Site, USA - Report August 29, 2005
4. Installation at Santa Cruz Test Site, USA - Report May 01, 2007

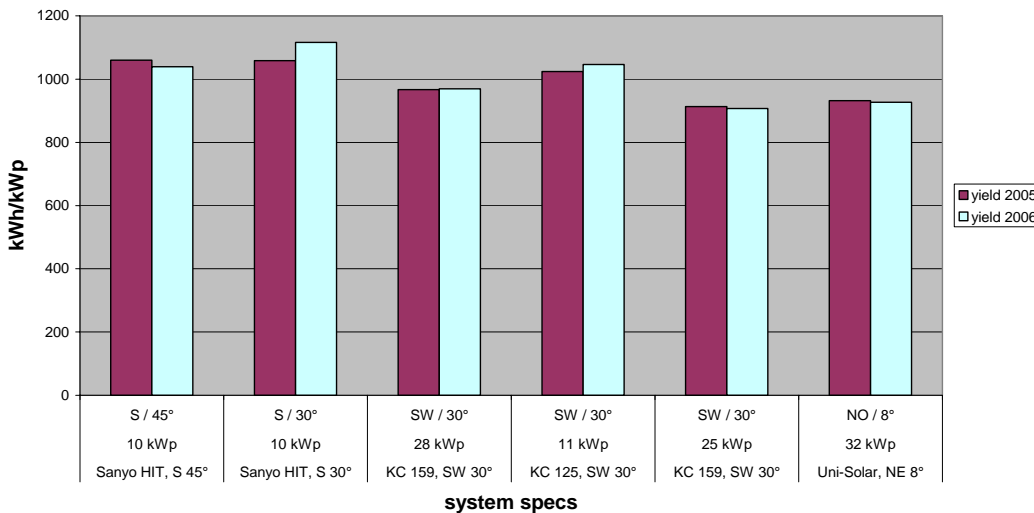
1. Rhön Region, Germany

Comparison of six PV installations in the Rhön Region, employing the following module types:

- Sanyo HIT
- Kyocera, multi-crystalline
- United Solar Ovonic triple junction

Please note: the UNI-SOLAR® installation is the only installation in this comparison facing north east, with 8 ° inclination

Comparison of different technologies and orientations, Rhön
NOTE: UNI-SOLAR® orientation: north east



Global Headquarters Sales & Manufacturing
United Solar Ovonic LLC
3800 Lapeer Road
Auburn Hills, MI 48326
USA
Toll free: +1.800.843.3892
Tel: +1.248.475.0100
Fax: +1.248.364.0510
info@uni-solar.com

European Headquarters Sales & Marketing
United Solar Ovonic Europe GmbH
Trakehner Strasse 7-9
60487 Frankfurt/Main
Germany
Tel: +49.69.7137667.0
Fax: +49.69.7137667.67
europeinfo@uni-solar.com

Southern European Sales Office
United Solar Ovonic Europe GmbH
Via Monte Baldo, 4
37069 Villafranca (VR)
Italy
Tel: +39.045.8600982
Fax: +39.045.8617738
italyinfo@uni-solar.com

Iberian Sales Office
United Solar Ovonic Europe GmbH
c/o Velazquez 99 - 1C
28006 Madrid
Spain
Tel: +34.91.4116133
Cell: +34.606.584252
spaininfo@uni-solar.com

French Sales Office
United Solar Ovonic Europe GmbH
c/o 17 bis Route de la Reine
92100 Boulogne
France
Cell: +33.666.850777
franceinfo@uni-solar.com

www.uni-solar.com

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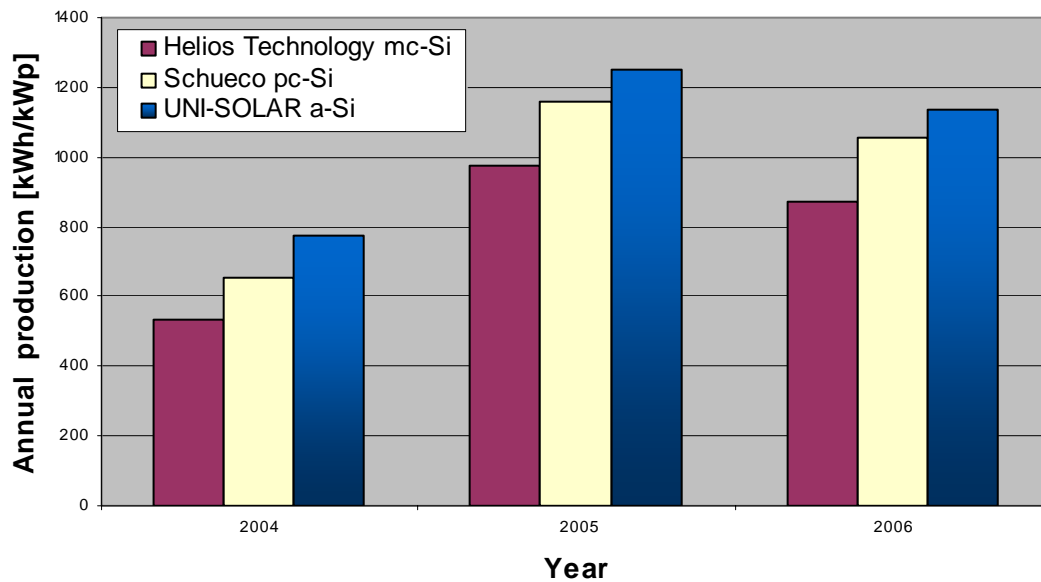
2. Bolzano, Italy

Installation in Bolzano, Italy, employing:

- Mono-crystalline cell technology from Helios
- Multi-crystalline Si cells from Schüco
- Triple-junction a-Si cells from UNITED SOLAR OVONIC



Annual energy production of different technologies



3. Update of PV System Performance Santa Cruz Test Site

Report August 29, 2005

Prepared by Allan Gregg UNITED SOLAR OVONIC LLC Auburn Hills, Michigan 48326

Introduction

This brief report presents the status of the performance for the four, 2.5 kW test systems on the Live Oak Business Park building in Santa Cruz, CA. These systems have been continuously monitored since their installation in late 2003. The four systems are described as follows:

US-116 Tilted Array – 2.5 kW of UNI-SOLAR® US-116 framed modules mounted at a 30 degree angle, south-facing, connected to an SMA inverter. Kyocera Crystalline Tilted Array – 2.5 kW of Kyocera 120 W crystalline modules mounted at a 30 degree angle, south-facing, connected to an SMA inverter. PVL Array #1 – 2.5 kW of UNI-SOLAR® PVL-128 modules adhered to a SPF roof at a 0 degree angle, connected to an SMA inverter. PVL Array #2 – 2.5 kW of UNI-SOLAR® PVL-128 modules adhered to a SPF roof at a 0 degree angle, connected to an SMA inverter.

These systems, located very near the ocean, are exposed to alternating sun and cloud cover that varies with season and time of day. The performance of the systems then, will be measured under conditions that are similar to weather environments across the country. Monitoring was done using an rMeter™ [1] data acquisition system (DAS) that compares the outputs of the set of systems under identical operating conditions and then displays the data on the World Wide Web to enable ready access for project participants and observers.



UNI-SOLAR® US-116 PV Array

Kyocera Crystalline PV Array

The intent of this demonstration/test project was to quantify the performance characteristics of similar systems located on the same roof. The variables were to be PV panel technology and mounting angle. In that way, the other performance variables, sunlight and ambient temperature would be identical for all systems under test. The impact of tilt angle could then be referenced to any installed cost factors that would favor the elimination of the array mounting structure.



UNI-SOLAR® US-116 PV Array



UNI-SOLAR® PVL-128 Laminite Array

The photo above is the horizontally mounted PV Laminite array. This is actually two 2,560 W PV arrays, each connected to its own 2.5 kW SMA inverter. The roof material is spray-in-place polyurethane foam coated with an acrylic protective layer.

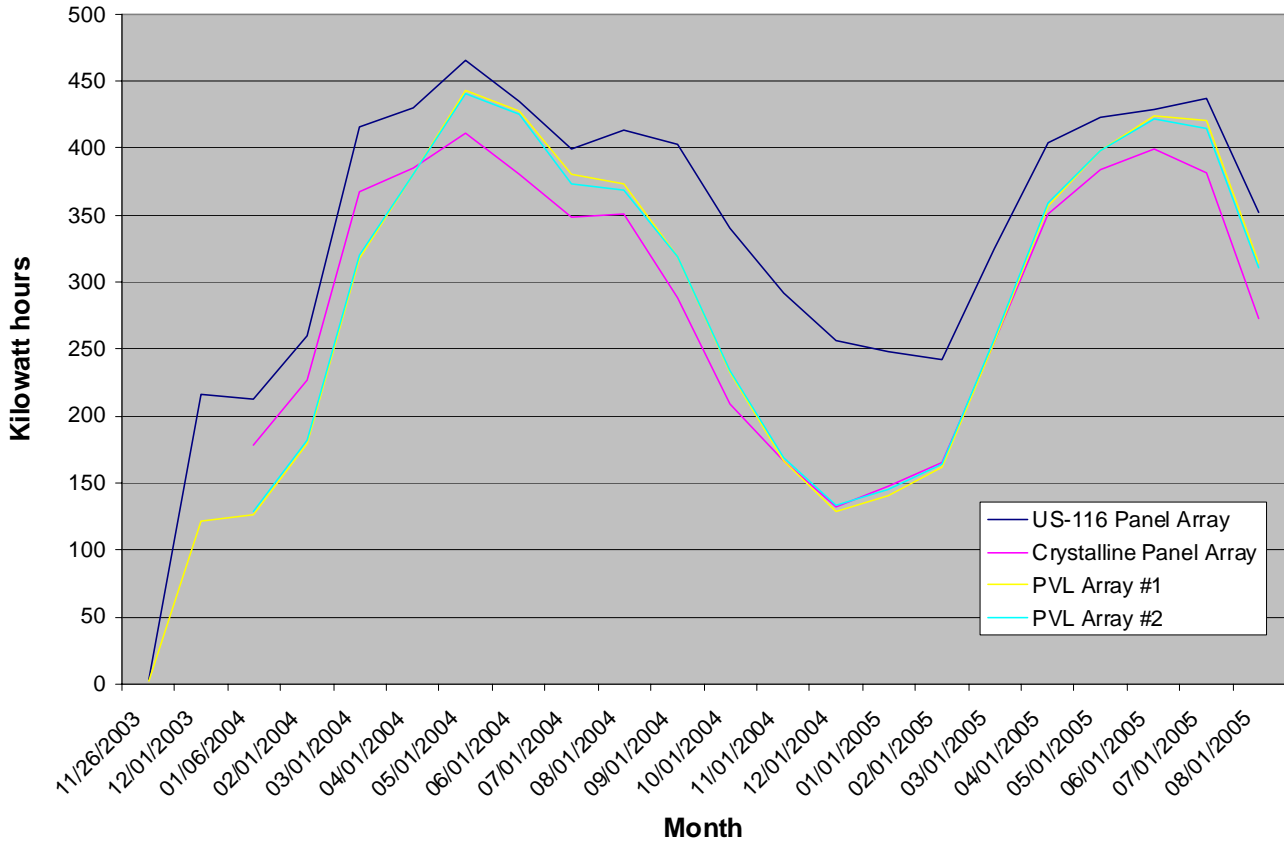
Performance Data Summary

The performance data shown in the table and the chart below show the relative energy production of the four systems measured at the output of each of the inverters. The trends that were described in the original report in December of 2004 are shown to continue in the first eight months of 2005. The tilted US-116 UNI-SOLAR® array continues to out-perform the crystalline array by more than 20 %. The UNI-SOLAR® PVL arrays have shown an energy output that is approximately equal to, but slightly better than the same-sized crystalline array, even though they are at a 0° slope, compared to the 30° slope of the crystalline array.

SANTA CRUZ TEST SITE - ENERGY PRODUCTION PERFORMANCE SUMMARY

Date	US-116 Panel Array	Crystalline Panel Array	PVL Array #1	PVL Array #2
11/26/2003	3.35		2.35	
12/01/2003	215.79		121.43	
01/06/2004	212.98	178.78	126.36	128.50
02/01/2004	259.24	226.92	179.36	181.58
03/01/2004	415.24	367.46	317.14	319.98
04/01/2004	429.88	385.36	380.78	380.46
05/01/2004	465.34	410.52	442.90	440.86
06/01/2004	435.20	380.12	426.94	425.00
07/01/2004	398.94	348.18	380.24	372.96
08/01/2004	413.00	350.98	373.20	368.16
09/01/2004	403.08	288.08	318.32	318.88
10/01/2004	340.64	209.06	232.52	233.58
11/01/2004	291.94	166.12	166.10	168.96
12/01/2004	256.82	132.18	128.94	133.28
01/01/2005	247.90	147.22	140.54	145.60
02/01/2005	242.56	164.72	161.98	164.56
03/01/2005	325.22	255.08	254.86	257.64
04/01/2005	403.76	350.12	356.38	359.08
05/01/2005	423.38	383.58	397.58	398.26
06/01/2005	428.86	399.36	424.46	421.66
07/01/2005	437.20	381.48	420.24	414.86
08/01/2005	351.86	272.86	313.94	310.26
Total kWhr	7402.18	5798.18	6066.56	5944.12
% Difference	0.00%	-21.67%	-18.04%	-19.70%

Santa Cruz Test Site - Energy Production



4. Update of PV System Performance Santa Cruz Test Site

Report May 01, 2007

Prepared by Terence Parker; Alen Chang; Chona Nunez United Solar Ovic LLC Auburn Hills, Michigan 48326

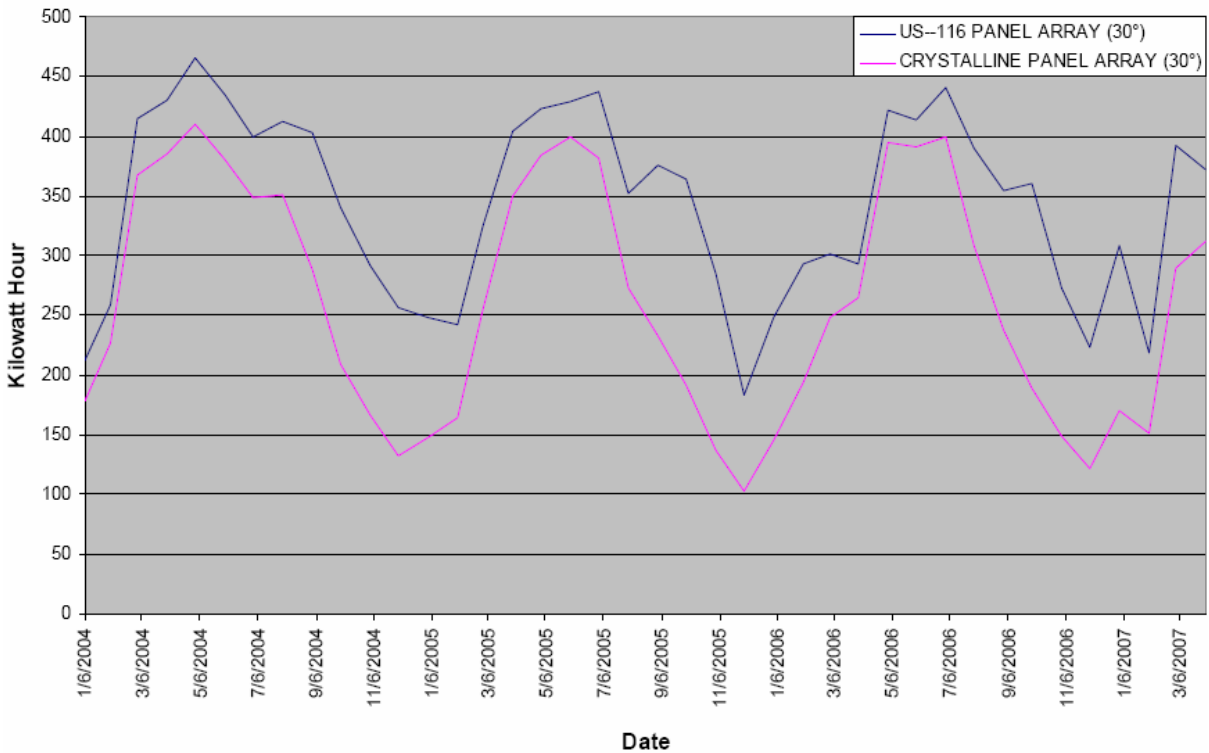
Introduction

This report updates the previous of report that issued at August 29, 2005 for the status of the performance for the four, 2.5 kW test systems on the Live Oak Business Park building in Santa Cruz, CA. These systems have been continuously monitored since their installation in late 2003.

Performance Data Summary

The performance data shown in the table and the chart below show the relative energy production of the four systems measured at the output of each of the inverters. The trend shows the output of each PV array since 2004. The tilted US-116 UNI-SOLAR® array continues to out-perform the crystalline array by more than 24 %.

Santa Cruz Test Site - Energy Production Performance Summary



Date	US-116 Panel Array (30°)	Crystalline Panel Array (30°)	PVL Array #1 (0°)	PVL Array #2 (0°)
Total kWh (2004)	4322.30	3443.76	3472.80	3472.20
% Difference	0.00%	-20.33%	-19.65%	-19.67%
01/01/2005	247.90	147.22	140.54	145.60
02/01/2005	242.56	164.72	161.98	164.56
03/01/2005	325.22	255.08	254.86	257.64
04/01/2005	403.76	350.12	356.38	359.08
05/01/2005	423.38	383.58	397.58	398.26
06/01/2005	428.86	399.36	424.46	421.66
07/01/2005	437.20	381.48	420.24	414.86
08/01/2005	351.86	272.86	313.94	310.26
09/01/2005	375.54	233.40	291.32	290.16
10/01/2005	363.54	191.46	242.32	244.48
11/01/2005	285.28	136.84	163.36	166.48
12/01/2005	183.24	102.50	101.38	104.42
Total kWh (2005)	4068.34	3018.62	3268.36	3277.46
% Difference	0.00%	-25.80%	-19.66%	-19.44%
01/01/2006	248.56	145.38	140.42	143.48
02/01/2006	292.80	193.32	187.26	190.38
03/01/2006	301.96	248.76	239.76	242.28
04/01/2006	293.62	265.04	261.54	262.28
05/01/2006	422.14	395.12	399.72	399.28
06/01/2006	413.88	391.62	405.12	403.44
07/01/2006	440.72	398.96	408.94	419.14
08/01/2006	390.20	308.30	354.00	336.90
09/01/2006	354.94	237.32	274.32	272.90
10/01/2006	360.26	189.22	241.66	243.88
11/01/2006	273.08	148.72	158.48	161.64
12/01/2006	223.28	122.14	118.42	122.52
Total kWh (2007)	4015.44	3043.90	3189.64	3198.12
% Difference	0.00%	-24.20%	-20.57%	-20.35%
01/01/2007	307.94	170.50	162.38	166.78
02/01/2007	219.04	151.18	149.96	153.04
03/01/2007	392.28	289.66	292.44	297.48
04/01/2007	372.24	312.26	321.96	326.06
Total kWh (2007)	1291.50	923.60	926.74	943.36
% Difference	0.00%	-28.49%	-28.24%	-26.96%
Total kWh (2004-2007)	13697.58	10429.88	10857.54	10891.14
% Difference	0.00%	-23.86%	-20.73%	-20.49%