

9 TESTS
of
TP4 SOLAR PERGOLAS

<u>Concentrated test report on TP4-enersol PV, TD and hybrid functions</u>							Athens	May 10 2015	Detailed graphs shown in .ppt and .pdf		
A)	<u>TP4-PV in East-West direction with solar tracking - against - flat horizontal PV-pergola</u>										
	<u>Date</u>	<u>Time</u>	<u>distance</u>	<u>TP4 + S.T.</u>	<u>W/h/m2</u>	<u>TP4 Flat</u>	<u>W/h/m2</u>	<u>tracker +%</u>			
1)	11/1/2015	9:00 - 15:30	c/c 250		82		63	30	In the first category we compare the		
2a)	17/2/2015	9:00 - 16:30	c/c 250		60		51	19	increase in PV output between our		
2b)	17/2/2015	9:00 - 16:30	c/c 333		68		51	33	TP4-panels in East to West direction		
3)	19/2/2015	8:30 - 11:00	c/c 250		86		48	78	with solar tracker and tilting device		
4)	20/2/2015	9:00 - 17:15	c/c 333		89		67	34	against the same panels turned into		
5)	21/2/2015	9:00 - 17:00	c/c 250		107	slope 45'	95	12	flat horizontal and fixed position.		
6)	1/3/2015	8:30 - 11:45	c/c 333		89		67	33	At morning and evening hours the		
7)	2/3/2015	8:30 - 12:00	c/c 250		88		71	23	increase reached up to + 100 % more		
8)	3/3/2015	8:30 - 17:00	c/c 333		91		75	22	and at noon values are naturally equal.		
9a)	15/3/2015	8:30 - 17:00	c/c 333		90		69	31			
9b)	15/3/2015	8:15 - 17:00	c/c 333		90	slope 40'	79	14	Medium increase of the East to West		
11 tests	medium output increase was				85		67	30 % plus	plus 1-axis solar tracking comes to +30%.		

Tests are performed on basis of comparing values of

a) TP4-Enersol TD-II-PV with rotation device

against

b) TP4 flat pergola with fixed PV-panels

and/or

c) TP4 Panels in South direction at 40' angle

If you need a horizontal PV-pergola construction then you must take into consideration following:

- a) The PV-panel has a reduced energy absorption when the solar height angle is less than 30'**
- b) The PV-panel has a reduced energy output whenever the panel surface get dusty and dirty**
- c) The horizontal PV-panel constructions are very difficult to keep clean and to maintenance**
- d) The large horizontal PV-panel area can easily be damaged by strong wind, snow and hail.**
- e) The maximum output efficiency is reached with PV-panels 90' (+/-20') against the insolation.**

TP4-Enersol rotatable solar panels solves problems

- a) TP4 solar pergola works with extremely low solar height angle (>10°)**
- b) By manual rotation of the panels they can easily be cleaned and maintained**
- c) motorized devices and solar tracker/sensors always turns the panels towards the insolation**
- d) The open air spacing between the panels make them stand strong against wind, snow and hail.**
- e) The TP4-panels always works 90° towards the insolation absorbing the maximum energy output**

NEXT PAGE

TP4 test 1

c/c=250 mm

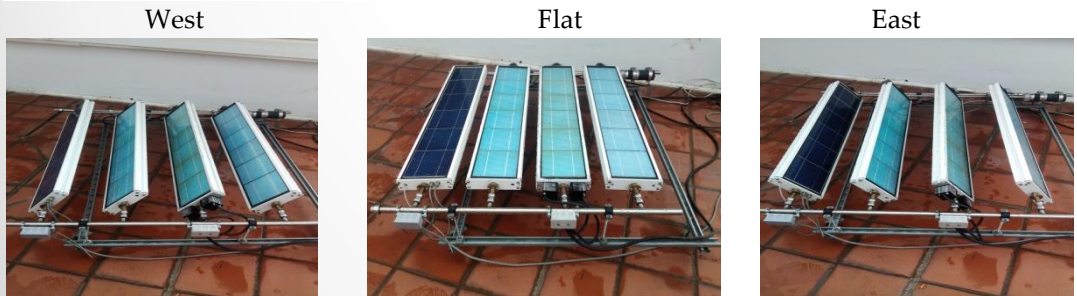
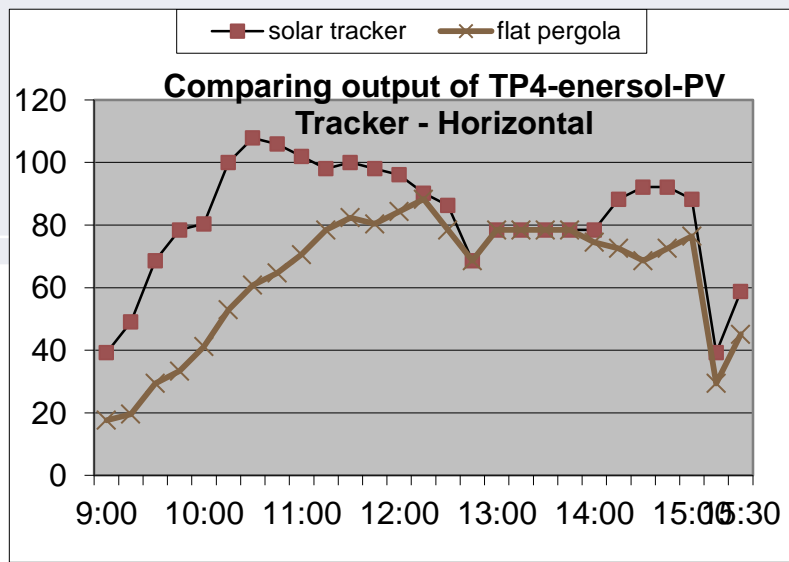
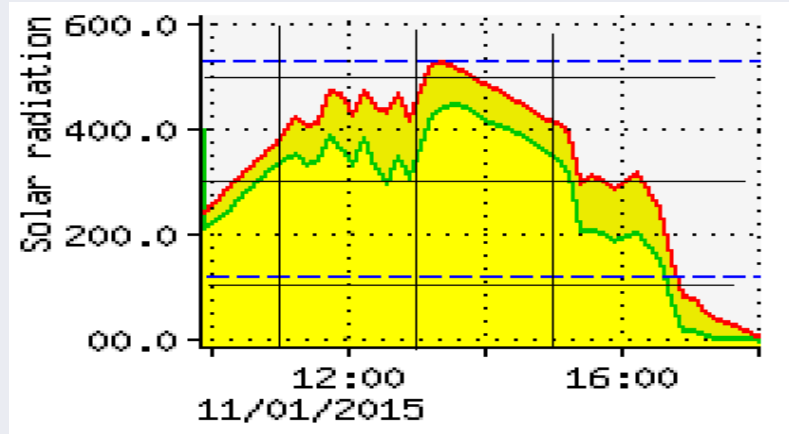
January 11 2015

Result was an increase of + 30%

Test comparing TP4 solar tracking against a fixed flat pergola

11 Jan 2015		Areos 22	P.Faliro	Terass	1 meter	0,153m2	PV	1 modul	0,15288
Test	Amp	Volt	Watt	W/m2	Time	Amp	Volt	Watt	W/m2
1	2	3	6	39	9:00	0,9	3	3	18
2	2,5	3	8	49		1,0	3	3	20
3	3,5	3	11	69		1,5	3	5	29
4	4	3	12	78		1,7	3	5	33
5	4,1	3	12	80	10:00	2,1	3	6	41
6	5,1	3	15	100		2,7	3	8	53
7	5,5	3	17	108		3,1	3	9	61
8	5,4	3	16	106		3,3	3	10	65
9	5,2	3	16	102	11:00	3,6	3	11	71
10	5,0	3	15	98		4,0	3	12	78
11	5,1	3	15	100		4,2	3	13	82
12	5,0	3	15	98		4,1	3	12	80
13	4,9	3	15	96	12:00	4,3	3	13	84
14	4,6	3	14	90		4,5	3	14	88
15	4,4	3	13	86		4,0	3	12	78
16	3,5	3	11	69		3,5	3	11	69
17	4,0	3	12	78	13:00	4,0	3	12	78
18	4,0	3	12	78		4,0	3	12	78
19	4,0	3	12	78		4,0	3	12	78
20	4,0	3	12	78		4,0	3	12	78
21	4,0	3	12	78	14:00	3,8	3	11	75
22	4,5	3	14	88		3,7	3	11	73
23	4,7	3	14	92		3,5	3	11	69
24	4,7	3	14	92		3,7	3	11	73
25	4,5	3	14	88	15:00	3,9	3	12	76
26	2,0	3	6	39		1,5	3	5	29
27	3,0	3	9	59	15:30	2,3	3	7	45
Total	tracker	c/c=250		2220	6,75hours	Total	horizont.	1704	
Medium output per /m2/h				82W/h/m2		130 %	W/h/m2	63	

Test of 1 meter PV working from East to West with TP4 Solar tracker & Flat Fixed Pergola
 Voltage was not recorded but estimated to 3 V
 Afternoon with reduced insolation due to clouds
 Morning hours shows an increase of >50%
 Noon hours shows approx. same figures
 Medium all over increase was + 30%



The result was an total increase of (+30%) for Solar Tracked TP4-panels at c/c 250 mm and refere to the daily energy output by solar tracker - compared to fixed flat pergola

TP4 test 2

February 17 2015

Double test

a) c/c 250 mm

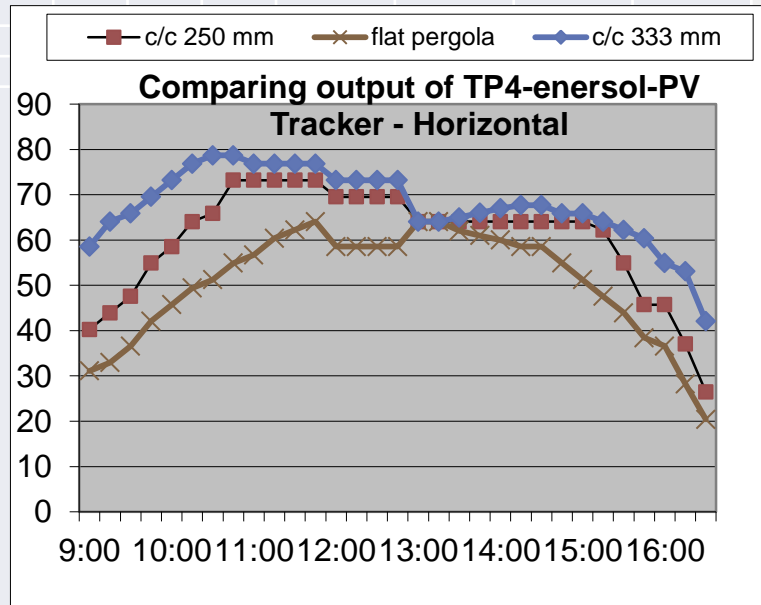
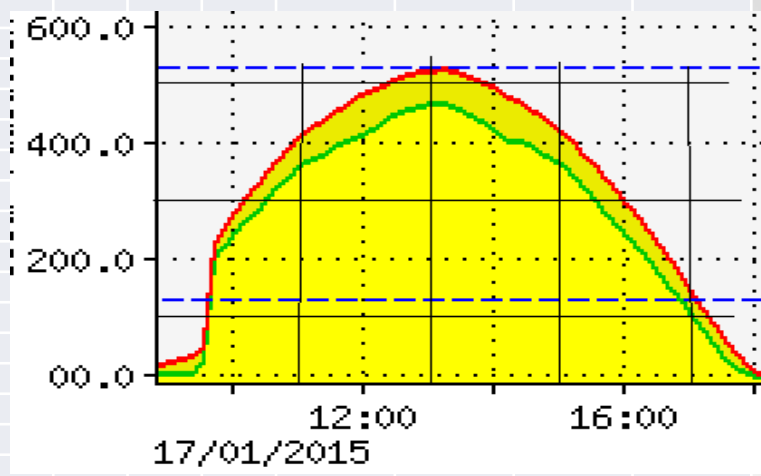
b) c/c 333 mm

Result a) was an increase of + 19%

Result b) was an increase of + 33%

Test comparing TP4 solar tracking against a fixed flat pergola

17 Feb 2015		Areos 22		P.Faliro	Terass	Area =	0,153m2	PV	1 modul	Comparing energy output on a flat roof installation								
Tracker c/c 250 mm					Tracker c/c 333 mm				Flat Horizontal									
Test	Amp	Volt	Watt	W/m2	Amp	Volt	Watt	W/m2	Time	Amp	Volt	Watt	W/m2	Panel distance varied between 250 and simulated 333 mm simulated 333 is achieved by rizing up backside 200 mm				
1	2,2	2,8	6	40	3,2	2,8	9	59	9:00	1,7	2,8	5	31					
2	2,4	2,8	7	44	3,5	2,8	10	64		1,8	2,8	5	33					
3	2,6	2,8	7	48	3,6	2,8	10	66		2,0	2,8	6	37					
4	3,0	2,8	8	55	3,8	2,8	11	70		2,3	2,8	6	42					
5	3,2	2,8	9	59	4,0	2,8	11	73	10:00	2,5	2,8	7	46					
6	3,5	2,8	10	64	4,2	2,8	12	77		2,7	2,8	8	49					
7	3,6	2,8	10	66	4,3	2,8	12	79		2,8	2,8	8	51					
8	4,0	2,8	11	73	4,3	2,8	12	79		3,0	2,8	8	55					
9	4,0	2,8	11	73	4,2	2,8	12	77	11:00	3,1	2,8	9	57					
10	4,0	2,8	11	73	4,2	2,8	12	77		3,3	2,8	9	60					
11	4,0	2,8	11	73	4,2	2,8	12	77		3,4	2,8	10	62					
12	4,0	2,8	11	73	4,2	2,8	12	77		3,5	2,8	10	64					
13	3,8	2,8	11	70	4,0	2,8	11	73	12:00	3,2	2,8	9	59					
14				70				73					59					
15	interpolated			70	interpolated			73		interpolated			59					
16				70				73					59					
17	3,5	2,8	10	64	3,5	2,8	10	64	13:00	3,5	2,8	10	64					
18	3,5	2,8	10	64	3,5	2,8	10	64		3,5	2,8	10	64					
19				64				65					62					
20	interpolated			64	interpolated			66		interpolated			61					
21				64				67	14:00				60					
22	3,5	2,8	10	64	3,7	2,8	10	68		3,2	2,8	9	59					
23	3,5	2,8	10	64	3,7	2,8	10	68		3,2	2,8	9	59					
24	3,5	2,8	10	64	3,6	2,8	10	66		3,0	2,8	8	55					
25	3,5	2,8	10	64	3,6	2,8	10	66	15:00	2,8	2,8	8	51					
26	3,4	2,8	10	62	3,5	2,8	10	64		2,6	2,8	7	48					
27	3,0	2,8	8	55	3,4	2,8	10	62		2,4	2,8	7	44					
28	2,5	2,8	7	46	3,3	2,8	9	60		2,1	2,8	6	38					
29	2,5	2,8	7	46	3,0	2,8	8	55	16:00	2,0	2,8	6	37					
30	2,1	2,7	6	37	2,8	2,9	8	53		1,6	2,7	4	28					
31	1,5	2,7	4	26	2,3	2,8	6	42		1,2	2,6	3	20					
Total W at c/c 250mm		1868		Total W at c/c 250mm		2096		Total W in flat position				1571						
hours		7,75				7,75						7,75						
W/h/m2		60		1,19		68		1,33				51						



Result was an increase (+19%) for panels c/c 250 mm) and (+33%) on panels c/c 333 mm and refers to the daily energy output by solar tracker - compared to fixed flat pergola

TP4 test 3

February 19 2015

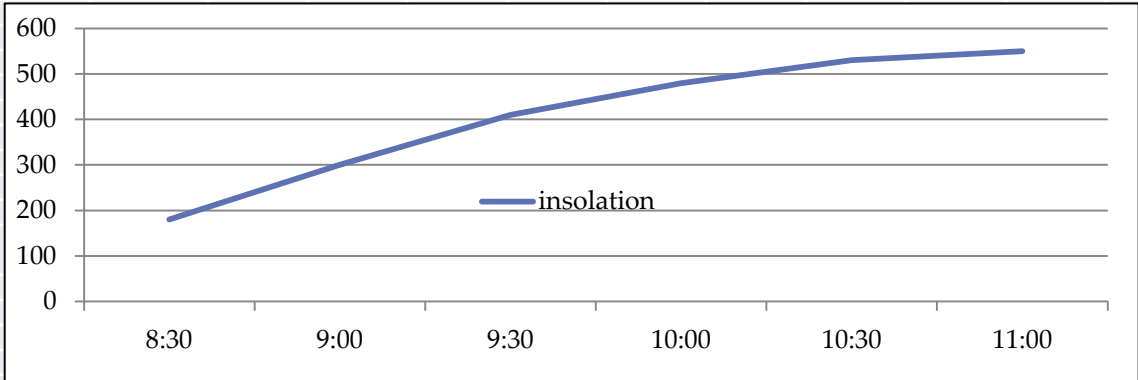
Morning hours

c/c 333 mm

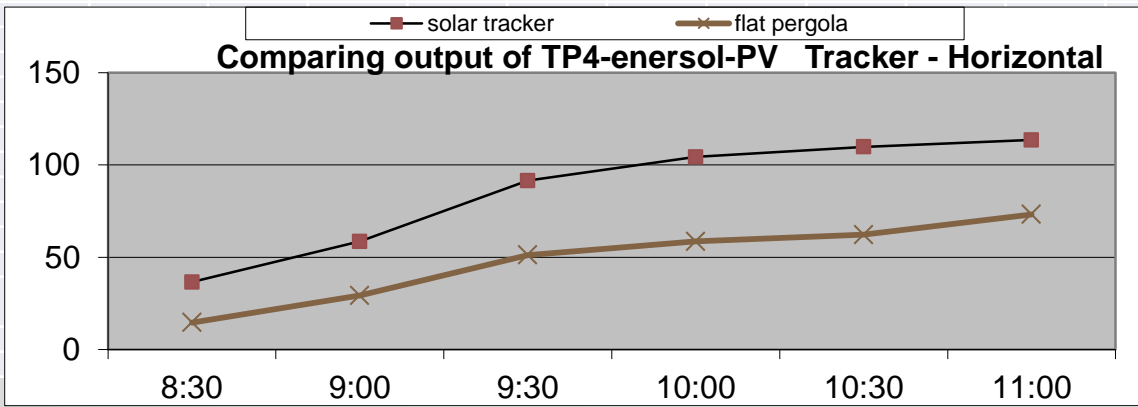
Result was an increase of + 78%

Test comparing TP4 solar tracking against a fixed flat pergola

19 Feb 2015	Areos22	P.Faliro	Terass	1 meter		0,153m2	PV 333	1 modul	0,15288	Comparing morning energy output tracking against flat pergola		
Test	Amp	Volt	Watt	tracker	Time	horizon.	Amp	Volt	Watt	W/m2	The test shows a significant increase in early morning hours	
1	2	2,8	6	37	8:30		180	0,8	2,8	2	15	Calculated over the 3 morning hours the increase was 78 %
2	3,2	2,8	9	59	9:00		300	1,6	2,8	4	29	compared to the flat horizontal PV-pergola installation
3	5,0	2,8	14	92	9:30		410	2,8	2,8	8	51	
4	5,7	2,8	16	104	10:00		480	3,2	2,8	9	59	
5	6,0	2,8	17	110	10:30		530	3,4	2,8	10	62	
6	6,2	2,8	17	113	11:00		550	4,0	2,8	11	73	
Total output in W by tracker				514	3	Total output in flat position				289		
Medium output / hour & m2				86	178%	Medium output / hour&m2				48		



Early morning insolation from East direction



Early morning insolation on flat fixed pergola

Result was an increase (+78%) on morning energy output compared to fixed flat pergola

TP4 test 4

February 20 2015

All day

c/c 333 mm

Result was an increase of + 34%

Test comparing TP4 solar tracking against a fixed flat pergola

20 Feb. -2015											
Test	Amp	Areos22 Volt	P.Faliro Watt	Terass tracker	1 meter Time	0,153m2 insolat.	Amp	PV 333 Volt	1 modul Watt	0,15288 Flat/m2	Comparing energy output on flat roof installation
1	2,8	2,8	2,8	8	51		150	0,8	2,8	2	15The test shows a great increase in morning & afternoon
2	3,5	2,8	2,8	10	64		250	1,2	2,8	3	22Calculated all over the day the increase reached + 34 %
3	4,3	2,8	2,8	12	79	9:00	350	1,6	2,8	4	29compared to a flat horizontal PV-panel pergola installation
4	4,8	2,8	2,8	13	88		400	2,2	2,8	6	40
5	5,1	2,8	2,8	14	93		450	2,5	2,8	7	46
6	5,2	2,8	2,8	15	95		500	2,9	2,8	8	53
7	5,3	2,8	2,8	15	97	10:00	550	3,3	2,8	9	60
8	5,4	2,8	2,8	15	99		575	3,6	2,8	10	66
9	5,5	2,8	2,8	15	101		600	3,8	2,8	11	70
10	5,6	2,8	2,8	16	102		625	4,0	2,8	11	73
11	5,8	2,8	2,8	16	106	11:00	650	4,2	2,8	12	77
12	5,5	2,8	2,8	15	101		675	4,7	2,8	13	86
13	5,5	2,8	2,8	15	101		700	4,8	2,8	13	88
14	5,4	2,8	2,8	15	99		725	4,9	2,8	14	90
15	5,4	2,8	2,8	15	99	12:00	750	5,0	2,8	14	92
16	5,5	2,8	2,8	15	101		750	5,2	2,8	15	95
17	5,5	2,8	2,8	15	101		750	5,4	2,8	15	99
18	5,6	2,8	2,8	16	102		750	5,6	2,8	16	102
19	5,6	2,8	2,8	16	102	13:00	750	5,6	2,8	16	102
20	5,5	2,8	2,8	15	101		750	5,4	2,8	15	99
21	5,5	2,8	2,8	15	101		725	5,2	2,8	15	95
22	5,3	2,8	2,8	15	97		725	5,0	2,8	14	92
23	5,2	2,8	2,8	15	95	14:00	700	4,9	2,8	14	90
24	5,2	2,8	2,8	15	95		700	4,7	2,8	13	86
25	5,1	2,8	2,8	14	93		650	4,5	2,8	13	82
26	5,1	2,8	2,8	14	93		600	4,4	2,8	12	81
27	5,1	2,8	2,8	14	93	15:00	550	4,3	2,8	12	79
28	5,1	2,8	2,8	14	93		500	4,0	2,8	11	73
29	5,1	2,8	2,8	14	93		450	3,6	2,8	10	66
30	4,6	2,8	2,8	13	84		400	3,5	2,8	10	64
31	4,8	2,8	2,8	13	88	16:00	350	3,2	2,8	9	59
32	4,2	2,8	2,8	12	77		310	2,3	2,8	6	42
33	4,0	2,8	2,8	11	73		280	2,0	2,8	6	37
34	3,4	2,8	2,8	10	62		240	1,6	2,8	4	29
35	2,7	2,8	2,8	8	49	17:00	200	0,8	2,8	2	15
36	2,4	2,8	2,8	7	44		180	0,4	2,8	1	7
Total output in W by tracker				3214	9hours	Total output in flat position				2399	
Medium output per hour & m2				89	134%	Medium output / hour & m2				67	



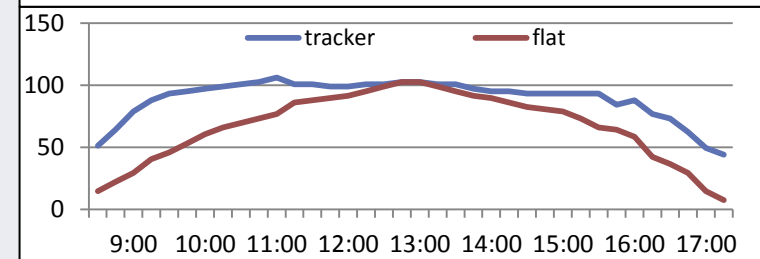
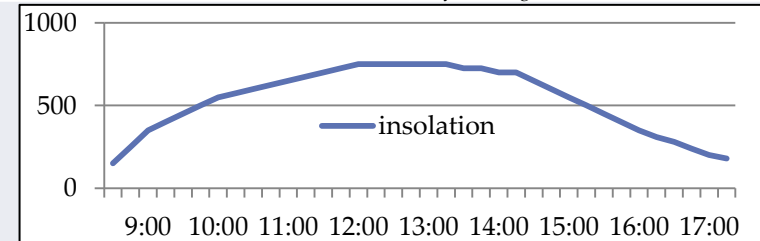
Simulated flat PV-pergola



Afternoon West direction



Early morning East direction



Result was an increase (+34%) on the daily energy output compared to fixed flat pergola

TP4 test 5

February 20 2015

45' inclination South

Against

45' inclination East-West

Result was an increase of + 12%

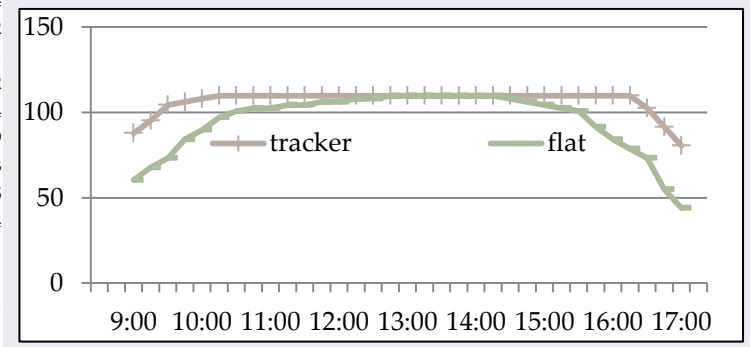
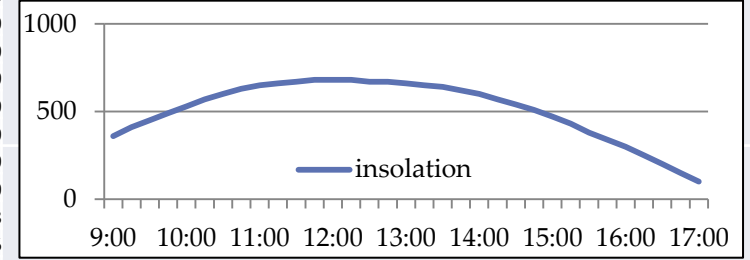
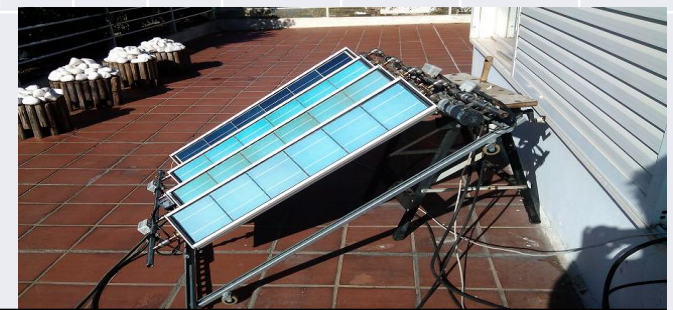
Test comparing TP4 solar tracking against a fixed installation

21 Feb 2015	Areos22	P.Faliro	Terass	1 meter	0,153m2	PV 333	1 modul	45' S		
Test	Amp	Volt	Watt	tracker	Time	insolat.	Amp	Volt	Watt	Flat/m2
1										
2										
3	4,8	2,8	13	88	9:00	360	3,3	2,8	9	60
4	5,2	2,8	15	95		410	3,7	2,8	10	68
5	5,7	2,8	16	104		450	4,0	2,8	11	73
6	5,8	2,8	16	106		490	4,6	2,8	13	84
7	5,9	2,8	17	108	10:00	530	4,9	2,8	14	90
8	6,0	2,8	17	110		570	5,3	2,8	15	97
9	6,0	2,8	17	110		600	5,5	2,8	15	101
10	6,0	2,8	17	110		630	5,6	2,8	16	102
11	6,0	2,8	17	110	11:00	650	5,6	2,8	16	102
12	6,0	2,8	17	110		660	5,7	2,8	16	104
13	6,0	2,8	17	110		670	5,7	2,8	16	104
14	6,0	2,8	17	110		680	5,8	2,8	16	106
15	6,0	2,8	17	110	12:00	680	5,8	2,8	16	106
16	6,0	2,8	17	110		680	5,9	2,8	17	108
17	6,0	2,8	17	110		670	5,9	2,8	17	108
18	6,0	2,8	17	110		670	6,0	2,8	17	110
19	6,0	2,8	17	110	13:00	660	6,0	2,8	17	110
20	6,0	2,8	17	110		650	6,0	2,8	17	110
21	6,0	2,8	17	110		640	6,0	2,8	17	110
22	6,0	2,8	17	110		620	6,0	2,8	17	110
23	6,0	2,8	17	110	14:00	600	6,0	2,8	17	110
24	6,0	2,8	17	110		570	6,0	2,8	17	110
25	6,0	2,8	17	110		540	5,9	2,8	17	108
26	6,0	2,8	17	110		510	5,8	2,8	16	106
27	6,0	2,8	17	110	15:00	470	5,7	2,8	16	104
28	6,0	2,8	17	110		430	5,6	2,8	16	102
29	6,0	2,8	17	110		380	5,5	2,8	15	101
30	6,0	2,8	17	110		340	5,0	2,8	14	92
31	6,0	2,8	17	110	16:00	300	4,6	2,8	13	84
32	6,0	2,8	17	110		250	4,3	2,8	12	79
33	5,6	2,8	16	102		200	4,0	2,8	11	73
34	5,0	2,8	14	92		150	3,0	2,8	8	55
35	4,4	2,8	12	81	17:00	100	2,4	2,8	7	44
Total output in W by tracker				3521	8,25hours	Total output in fixed posit.				3131
Medium output per hour & m2				107	112%	Medium output per hour & m2				95

Comparing energy output test on 45' sloped tiled roof
Panel distance 333 mm Direction East to West

The test shows an increase in morning and afternoon
Calculated all over the day the increase is about +12%

Conclusion: less degrees slope = greater output increase
Maximum energy output gained on flat roof installations



Result was an increase (+12%) on daily energy output compared to 45' fixed installation

TP4 test 6

March 1 2015

Morning hours

c/c 333 mm

Result was an increase of + 33%

Test comparing TP4 solar tracking against a fixed installation

01 Mars 2015		Areos22	P.Faliro	Terass	1 meter	0,153m2	PV 333	1 modul	0,15288		
Test	Amp	Volt	Watt	tracker	Time	insolat.	Amp	Volt	Watt	W/m2	
1	3,3	2,8	9	60	8:30	150	1,5	2,8	4	27	
2	4,2	2,8	12	77	8:45	300	2,0	2,8	6	37	
3	4,6	2,8	13	84	9:00	350	2,4	2,8	7	44	
4	5,0	2,8	14	92	9:15	390	3,0	2,8	8	55	
5	5,2	2,8	15	95	9:30	430	3,2	2,8	9	59	
6	5,4	2,8	15	99	9:45	480	3,6	2,8	10	66	
7	5,5	2,8	15	101	10:00	530	4,0	2,8	11	73	
8	5,5	2,8	15	101	10:15	560	4,3	2,8	12	79	
9	5,5	2,8	15	101	10:30	600	4,6	2,8	13	84	
10	5,5	2,8	15	101	10:45	640	4,8	2,8	13	88	
11	5,5	2,8	15	101	11:00	700	5,0	2,8	14	92	
12	5,2	2,8	15	95	11:15	640	4,7	2,8	13	86	
13	5,5	2,8	15	101	11:30	680	5,3	2,8	15	97	
14	5,6	2,8	16	102	11:45	730	5,5	2,8	15	101	
Total output in W by tracker				1308	3,5	3590	Total output in flat position				986

Comparing morning energy output tracking against flat pergola

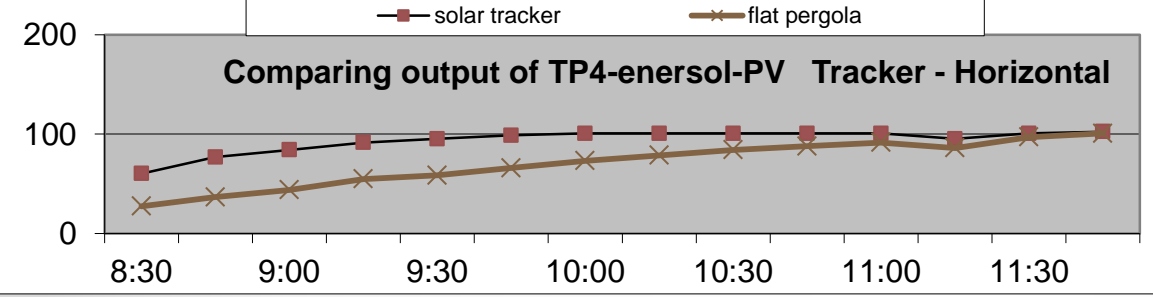
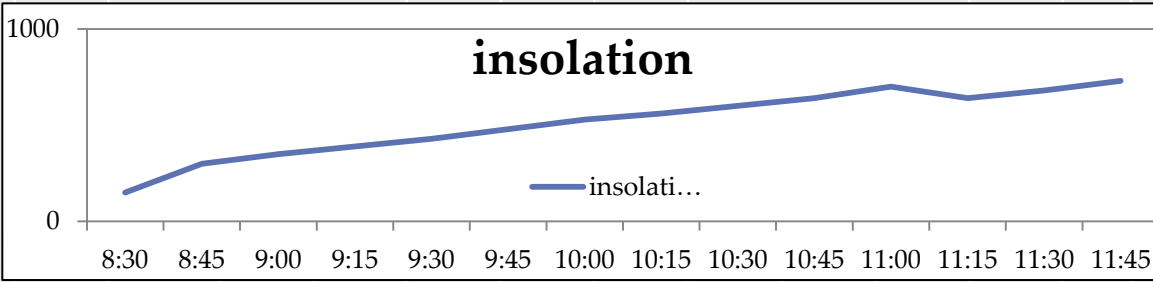
The test shows a significant increase in early morning hours
 Calculated over the 3,5 morning hours the increase was 33 %
 compared to the flat horizontal PV-pergola installation



Early morning insolation from East direction



Early morning insolation on flat fixed pergola



Result was an increase (+33%) on morning energy output compared to a flat pergola

TP4 test 7

March 2 2015

Morning hours

c/c 333 mm

Result was an increase of + 23%

Test comparing TP4 solar tracking against a fixed installation

02 Mars 2015	Areos22	P.Faliro	Terass	1 meter	0,153m2	PV 333	1 modul	0,15288			
Test	Amp	Volt	Watt	tracker	Time	insolat.	Amp	Volt	Watt	W/m2	
1	4	2,8	11	73	8:30	270	2,0	2,8	6	37	
2	4,3	2,8	12	79	8:45	320	2,4	2,8	7	44	
3	4,3	2,8	12	79	9:00	360	2,8	2,8	8	51	
4	2,1	2,8	6	38	9:15	280	1,5	2,8	4	27	
5	3,0	2,8	8	55	9:30	420	2,2	2,8	6	40	
6	5,0	2,8	14	92	9:45	500	3,9	2,8	11	71	
7	5,4	2,8	15	99	10:00	540	4,1	2,8	11	75	
8	5,4	2,8	15	99	10:15	550	4,6	2,8	13	84	
9	5,5	2,8	15	101	10:30	620	4,8	2,8	13	88	
10	5,5	2,8	15	101	10:45	640	4,0	2,8	11	73	
11	5,5	2,8	15	101	11:00	660	5,1	2,8	14	93	
12	5,6	2,8	16	102	11:15	680	5,2	2,8	15	95	
13	5,5	2,8	15	101	11:30	700	5,2	2,8	15	95	
14	5,5	2,8	15	101	11:45	700	5,3	2,8	15	97	
15	5,6	2,8	16	102	12:00	730	5,4	2,8	15	99	
Total output in W by tracker				330	3,75	1810	Total output in flat position				268
Medium output / hour & m2				88	123%	Medium output / hour&m2				71	

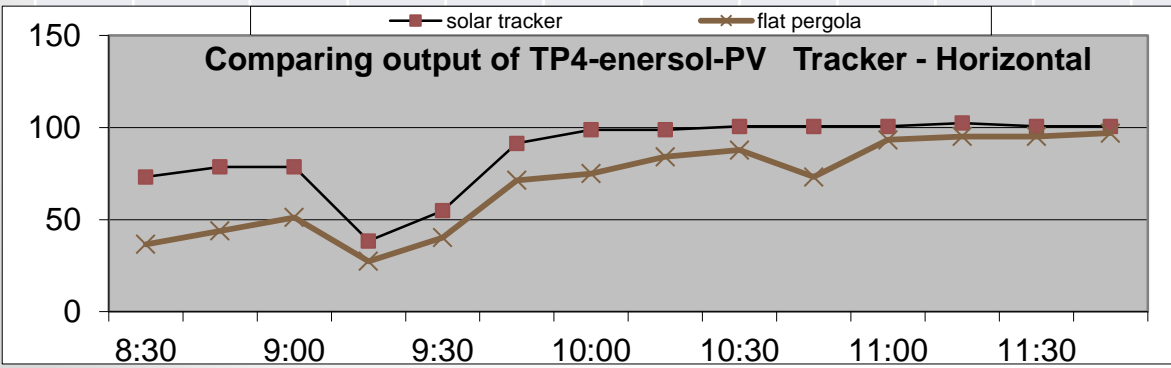
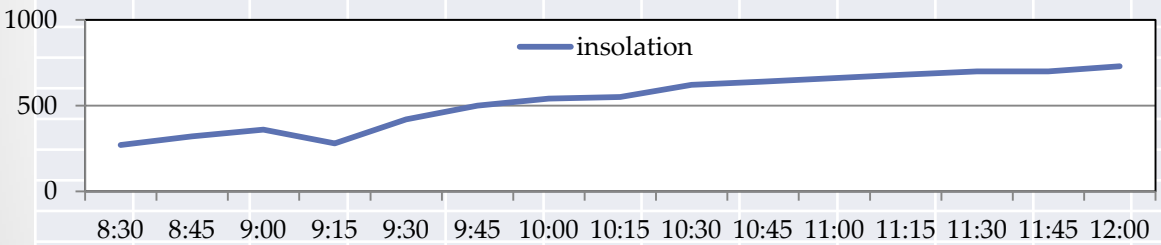
Comparing morning energy output tracking against flat pergola
 The test shows a significant increase in early morning hours
 Calculated over the 3,5 morning hours the increase was 33 %
 compared to the flat horizontal PV-pergola installation



Early morning insolation from East direction



Early morning insolation on flat fixed pergola



Result was an increase (+23%) on morning energy output compared to a flat pergola

TP4 test 8

March 3 2015

All day

c/c 333 mm

Result was an increase of + 22%

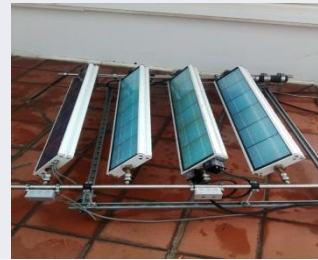
Test comparing TP4 solar tracking against a fixed installation

3 Mars-2015	Areos22	P.Faliro	Terass	1 meter	0,153m2	PV 333	1 modul	0,15288		
Test	Amp	Volt	Watt	tracker	Time	insolat.	Amp	Volt	Watt	Flat/m2
1	4,3	2,8	12	79		150	2	2,8	6	37
2	4,5	2,8	13	82		280	2,4	2,8	7	44
3	2,8	2,8	8	51	9:00	250	1,5	2,8	4	27
4	3	2,8	8	55		300	2,0	2,8	6	37
5	5	2,8	14	92		450	3,6	2,8	10	66
6	5,4	2,8	15	99		500	3,9	2,8	11	71
7	5,4	2,8	15	99	10:00	540	4,1	2,8	11	75
8	5,5	2,8	15	101		570	4,6	2,8	13	84
9	5,5	2,8	15	101		620	4,8	2,8	13	88
10	5,5	2,8	15	101		650	5,0	2,8	14	92
11	5,5	2,8	15	101	11:00	660	5,1	2,8	14	93
12	5,5	2,8	15	101		680	5,2	2,8	15	95
13	5,5	2,8	15	101		710	5,2	2,8	15	95
14	5,6	2,8	16	102		720	5,3	2,8	15	97
15	5,6	2,8	16	102	12:00	740	5,4	2,8	15	99
16	5,6	2,8	16	102		750	5,5	2,8	15	101
17	5,6	2,8	16	102		760	5,5	2,8	15	101
18	5,6	2,8	16	102		760	5,5	2,8	15	101
19	5,6	2,8	16	102	13:00	750	5,5	2,8	15	101
20	5,5	2,8	15	101		750	5,5	2,8	15	101
21	5,5	2,8	15	101		740	5,4	2,8	15	99
22	5,5	2,8	15	101		730	5,4	2,8	15	99
23	5,4	2,8	15	99	14:00	720	5,2	2,8	15	95
24	5,3	2,8	15	97		700	5	2,8	14	92
25	5,2	2,8	15	95		670	4,8	2,8	13	88
26	5,1	2,8	14	93		640	4,6	2,8	13	84
27	5,0	2,8	14	92	15:00	610	4,4	2,8	12	81
28	4,9	2,8	14	90		580	4,2	2,8	12	77
29	4,5	2,8	13	82		550	3,4	2,8	10	62
30	4,0	2,8	11	73		500	3,2	2,8	9	59
31	5,0	2,8	14	92	16:00	460	3,0	2,8	8	55
32	4,7	2,8	13	86		420	2,9	2,8	8	53
33	4,5	2,8	13	82		370	2,4	2,8	7	44
34	4,9	2,8	14	90		300	2,3	2,8	6	42
35	3,8	2,8	11	70	17:00	260	1,8	2,8	5	33
36	3,5	2,8	10	64		220	1,5	2,8	4	27
Total output in W by tracker				820	9	Total output in flat position				673
Medium output per hour & m2				91	122%	Medium output / hour & m2				75

Comparing energy output on flat roof installation
 Panel distance at simulated 333 mm Direction East - West
 The test shows a great increase early morning & afternoon
 Calculated all over the day the increase reached + 22 %
 compared to a flat horizontal PV-panel pergola installation



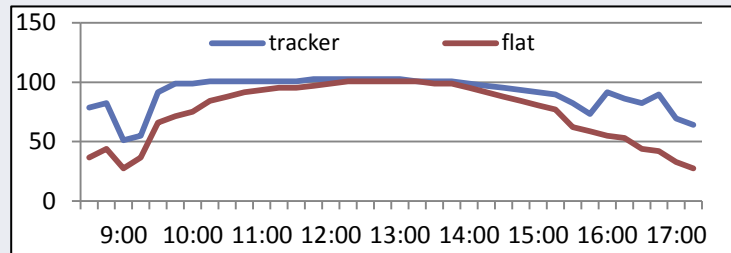
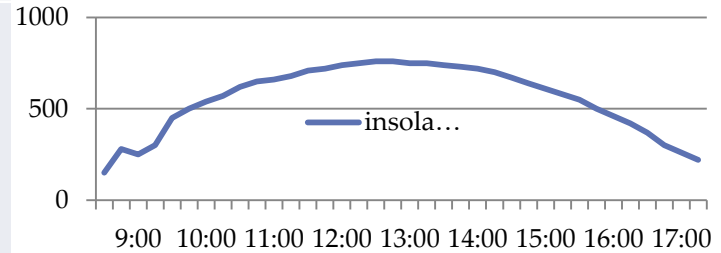
Simulated flat PV-pergola



Afternoon West direction



Early morning East direction



Result was an increase (+22%) on daily energy output compared to a flat pergola

TP4 test 9

March 15 2015

Interrupted day

c/c 333 mm

Result was an increase of + 33%

Test comparing TP4 solar tracking against a fixed installation

15 Mars 2015	Areos22	P.Faliro	Terass	1 meter		0,153E/W	PV333	flat		0,1529	south	PV333	40'	TEST RESULTS +33% and +14%	
Test	Amp	Volt	Watt	tracker	Time	insolat.	Amp	Volt	Watt	W/m2	Amp	Volt	Watt	W/m2	
1	3,5	2,8	10	64	8:15	260	1,8	2,8	5	33	1,8	2,8	5	33	The TP4 test gives an output increase of
2	4	2,8	11	73	8:30	300	2,0	2,8	6	37	2,3	2,8	6	42	+33% for East-West direction against
3	4,5	2,8	13	82	8:45	350	2,5	2,8	7	46	3	2,8	8	55	the flat pergola positioning and also
4	4,8	2,8	13	88	9:00	400	2,9	2,8	8	53	3,5	2,8	10	64	+14% compared to South 40' direction
5	5,0	2,8	14	92	9:15	440	3,2	2,8	9	59	4	2,8	11	73	Note: Due to bad weather at midday hours
6	5,2	2,8	15	95	9:30	480	3,5	2,8	10	64	4,4	2,8	12	81	test was not running all around the day
7	5,2	2,8	15	95	9:45	530	4,0	2,8	11	73	4,7	2,8	13	86	
8	5,3	2,8	15	97	10:00	570	4,4	2,8	12	81	4,7	2,8	13	86	
9	5,3	2,8	15	97	10:15	600	4,6	2,8	13	84	5,1	2,8	14	93	
10	5,3	2,8	15	97	10:30	630	4,6	2,8	13	84	5,2	2,8	15	95	
11	5,6	2,8	16	102	12:45	680	5,6	2,8	16	102	5,6	2,8	16	102	
12	5,9	2,8	17	108	14:30	720	5,6	2,8	16	102	6,2	2,8	17	113	
13	5,4	2,8	15	99	14:45	670	5,0	2,8	14	92	5,4	2,8	15	99	
14	5,3	2,8	15	97	15:15	600	4,7	2,8	13	86	5,2	2,8	15	95	
15	5,4	2,8	15	99	15:30	650	4,5	2,8	13	82	5,3	2,8	15	97	
16	5,4	2,8	15	99	15:45	600	4,4	2,8	12	81	5,2	2,8	15	95	
17	4,7	2,8	13	86	16:30	380	3,0	2,8	8	55	4,4	2,8	12	81	
18	4,0	2,8	11	73	16:45	350	2,6	2,8	7	48	3,3	2,8	9	60	
19	3,4	2,8	10	62	17:00	300	2,4	2,8	7	44	2,7	2,8	8	49	
Total output by tracker				90	3,75	501Total output flat position				69Total output south				79	
Medium increase against flat]				131%				Medium increase against south				114 %			



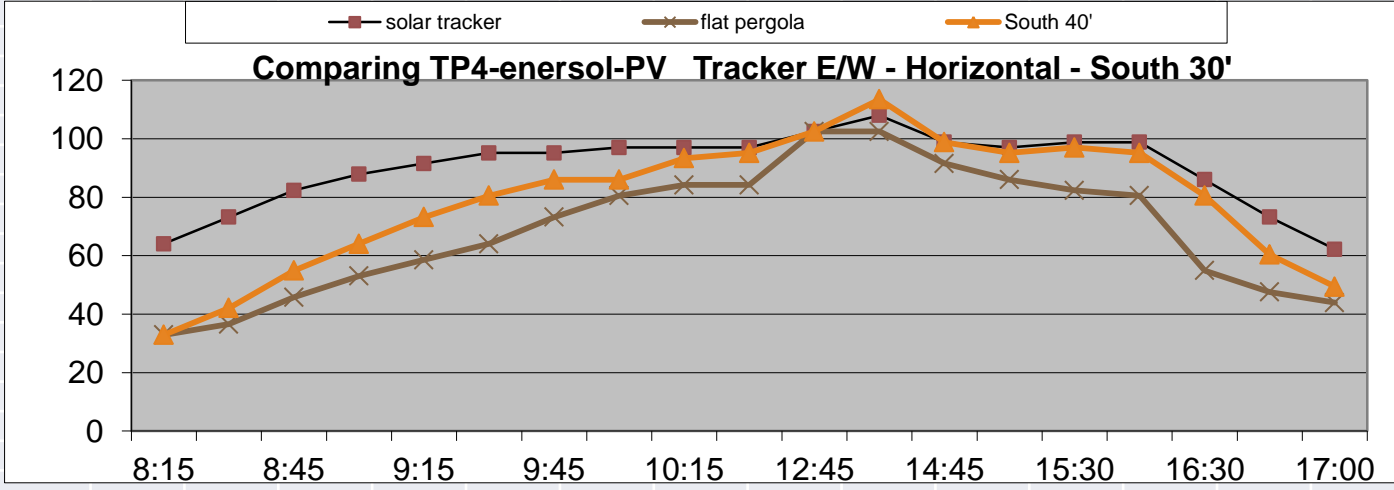
East-West direction



Flat pergola position



South direction 40'



Result was an increase (+33%) compared to a flat pergola and (+14%) to South position.

TP4 test conclusions

These tests proof the fact that energy output of TP4 is approximately 30 % higher then of flat PV-modules

Consider that the TP4-panels have a built-in hybrid PV-cooling function by its thermodynamic Cu-pipe and have an excellent access to surface-cleaning compared to cleaning problems of a flat pergola.

The expected total increase of energy output might reach as much as + 40% compared to conventional PV-panels mounted as a flat horizontal solar pergola.

END
of
TEST
REPORT