



UNIVERSITÀ
DEGLI STUDI DI TRIESTE



Rapporti OM

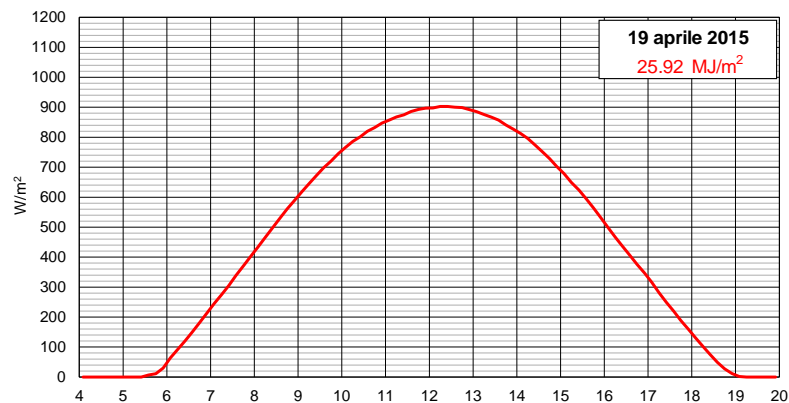
N. 176

Tullio Quaia
Stefano Cirilli

TRIESTE

Irradianza solare globale

2015



Trieste 2017

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TRIESTE

Irradianza solare globale

2015

Tullio Quaia, Stefano Cirilli

Questo rapporto aggiorna i dati orari di irradianza solare globale registrati a Trieste dal 1971 (Stravisi, 1986*b*; Stravisi *et al.*, 1986; Stravisi, 2004*c,d*, 2005, 2006, 2007, 2008, 2009, 2010, 2011; Stravisi & Cirilli, 2012, 2013, 2014; Quaia *et al.*, 2017) a tutto il 2015. Il piranometro è lo stesso (Kipp & Zonen CM11 n. 882127) usato negli anni precedenti presso la stazione meteorologica di Trieste del Dipartimento di Matematica e Geoscienze (DMG) di piazza Hortis n° 1, sita sul tetto dell'I.S.I.S. Nautico 'Tommaso di Savoia Duca di Genova'. Il supporto del piranometro, collocato sul palo di sostegno degli anemometri, guarda a sud (fig. 1). I dati di irradianza media su intervalli successivi di 10 minuti sono memorizzati da un datalogger Nesa TMF500; la costante di calibrazione utilizzata (Stravisi, 2004*c*) è $4.95 \text{ mV}/(\text{W}/\text{m}^2)$.



Fig. 1 - La stazione meteorologica DMG-Trieste con il piranometro Kipp & Zonen CM11 sul supporto sud.

La serie annuale è corretta per la deriva dello zero sommando giornalmente una costante in modo che i dati notturni risultino pari al loro valore medio di $-4 \text{ W}/\text{m}^2$; successivamente i dati degli intervalli di 10 min notturni (elevazione del sole sull'orizzonte astronomico $\leq -1.5^\circ$) sono posti uguali a zero.

I dati di irradianza solare globale medi in 10 min sono memorizzati come numeri interi espressi in watt al metro quadrato (W/m^2); successivamente sono convertiti in dati di irradiazione totale in 10 min, espressi in kilojoule al metro quadrato (kJ/m^2) e arrotondati all'intero. I totali giornalieri di irradiazione sono espressi in megajoule al


metro quadrato (MJ/m^2) e arrotondati a due decimali. L'ultima riga di ogni mese riporta l'irradiazione totale mensile. E' usato il tempo medio dell'Europa centrale CET = UTC+1, pari al tempo coordinato universale (tempo medio di Greenwich) più un'ora, ovvero l'ora solare locale.


Sono riportati i grafici giornalieri della serie di irradianza solare globale 2015 (in W/m^2) consistente in dati medi su intervalli consecutivi di 10 minuti (Stravisi, 2004d). Su ciascun grafico viene anche indicato il valore dell'irradiazione totale giornaliera (MJ/m^2).

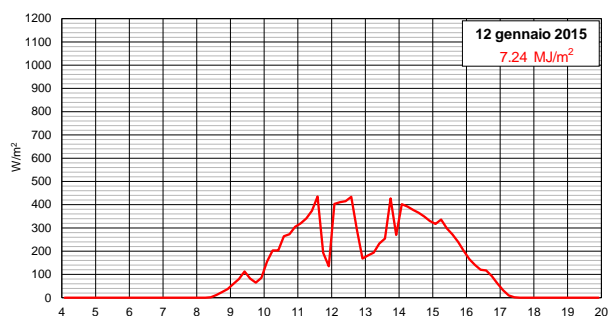
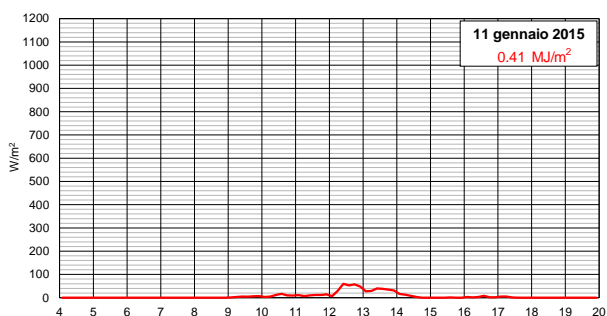
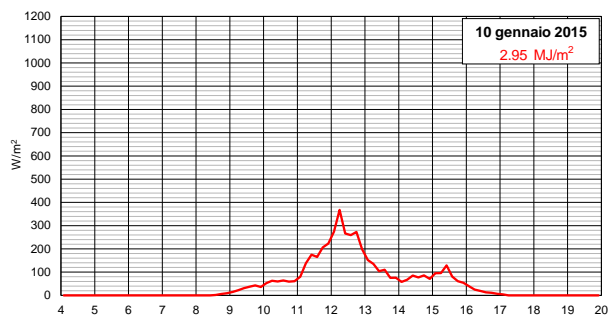
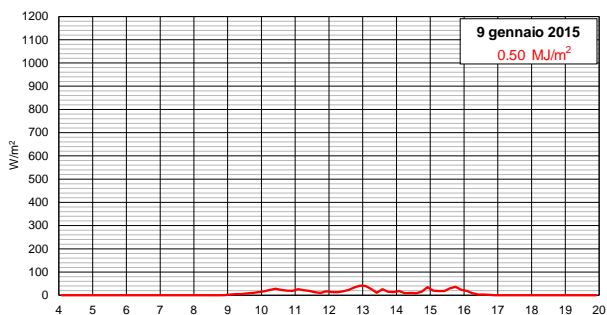
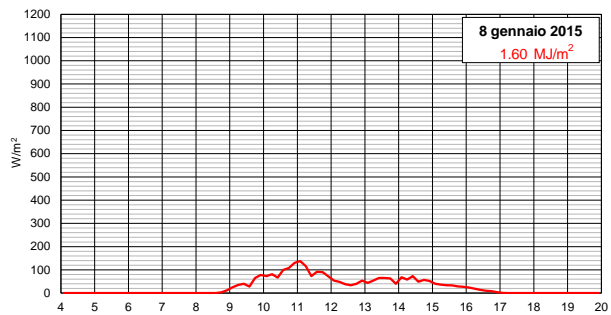
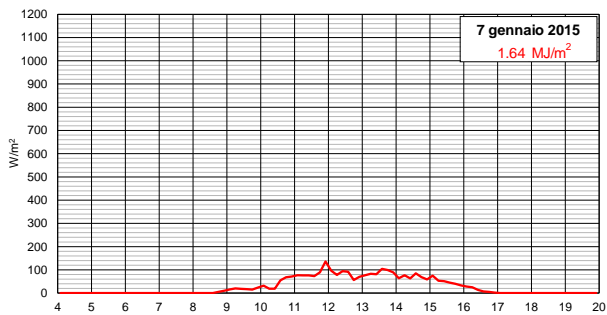
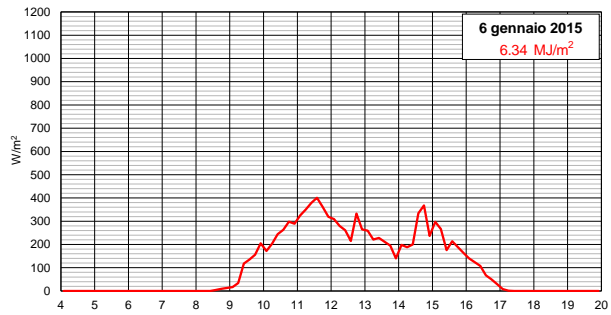
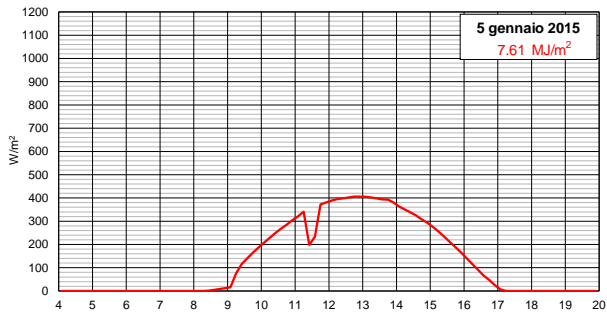
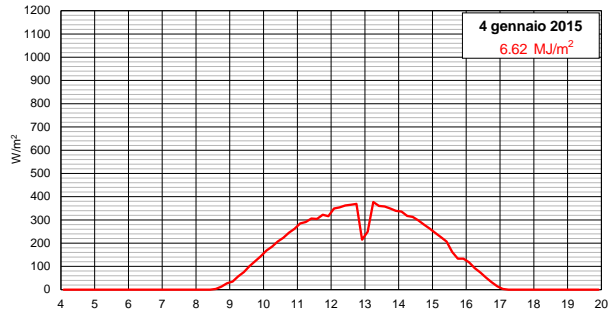
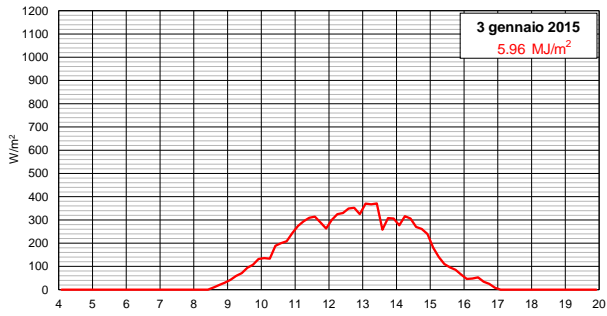
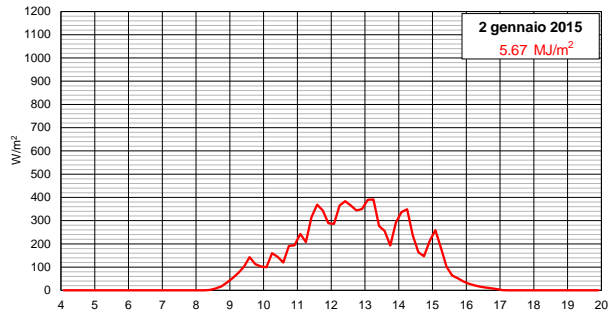
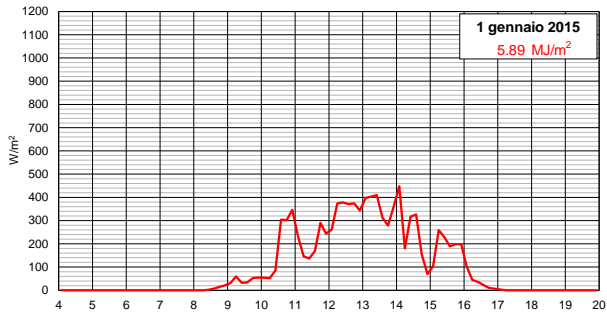
Ringraziamenti - Ringraziamo la famiglia Stravisi per aver reso possibile, con il finanziamento del Premio di Ricerca 'Franco Stravisi' istituito nel 2016 presso l'Ateneo triestino, la prosecuzione di questa linea di ricerca, iniziata negli anni '80 dal compianto Professor Stravisi e da lui coordinata sempre con competenza, dedizione e appassionato entusiasmo fino alla sua prematura scomparsa. E' alla sua memoria che dedichiamo, riconoscenti, questo lavoro.

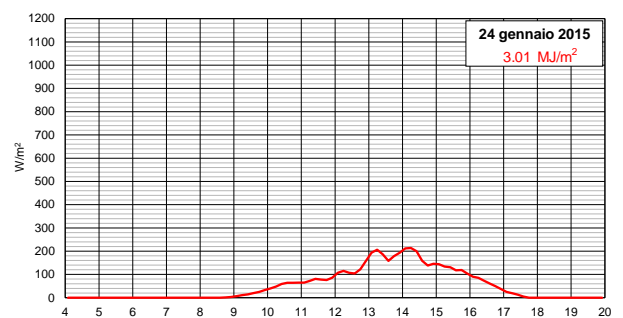
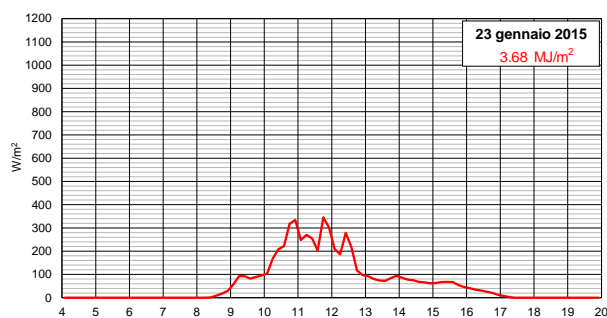
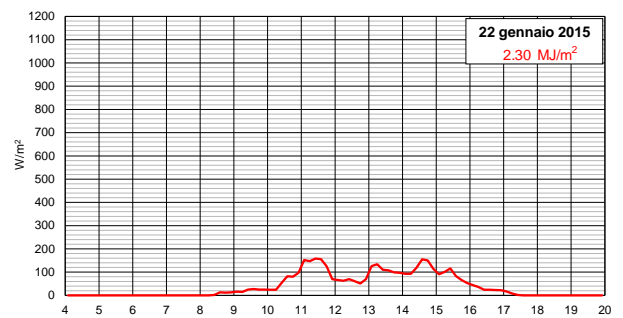
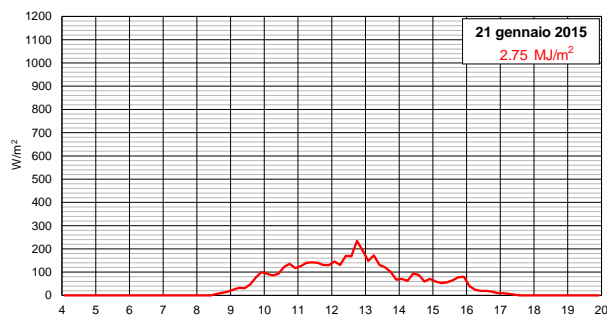
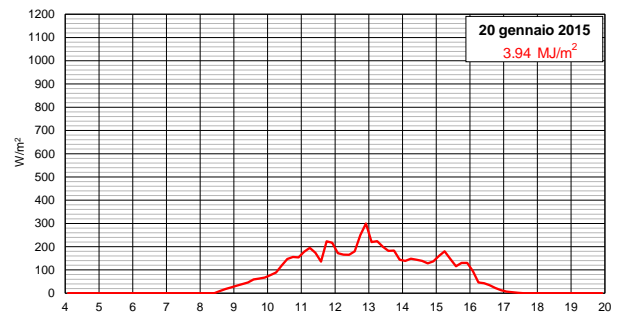
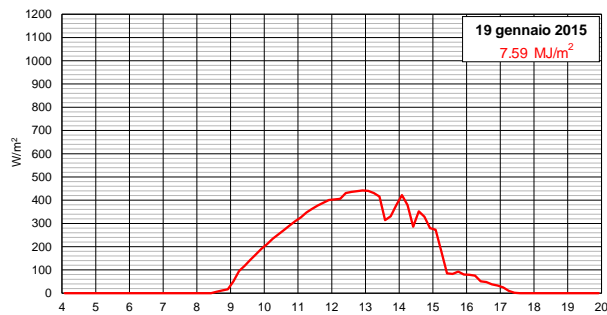
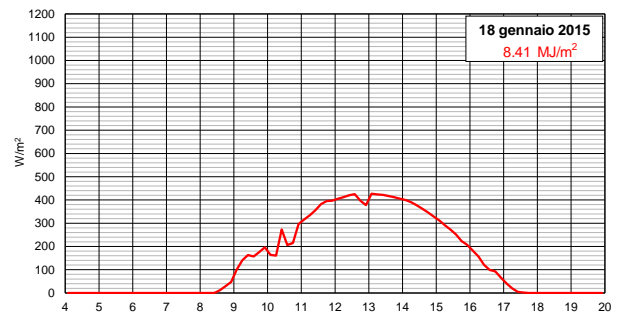
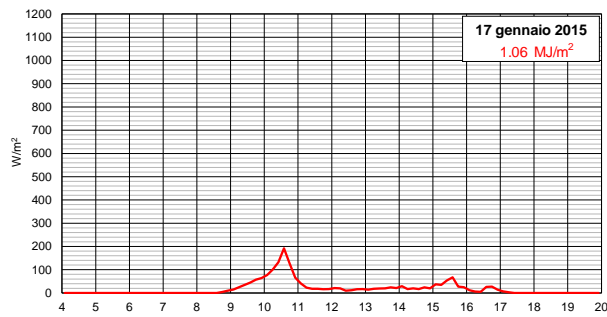
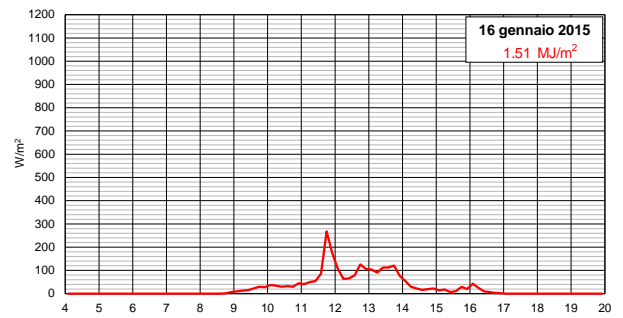
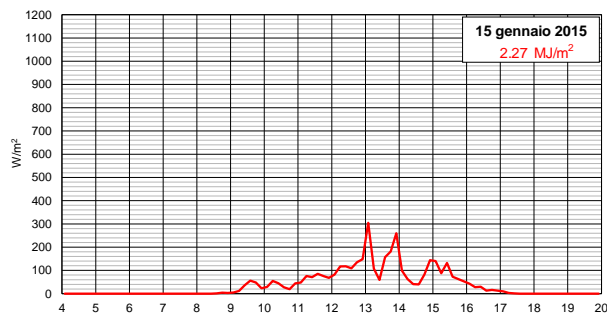
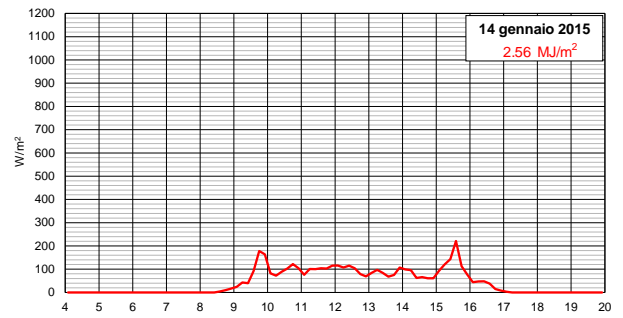
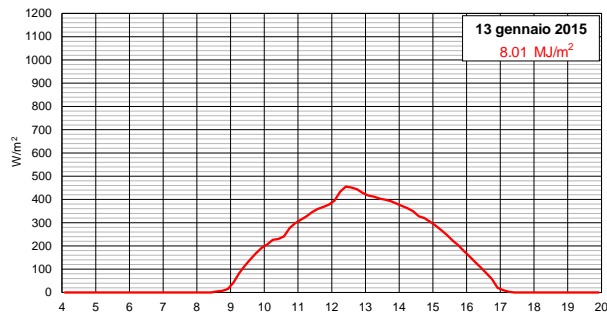
Riferimenti

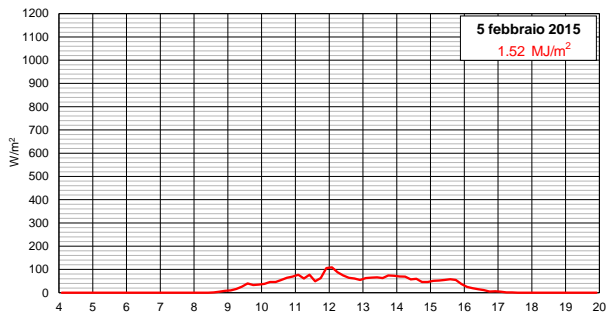
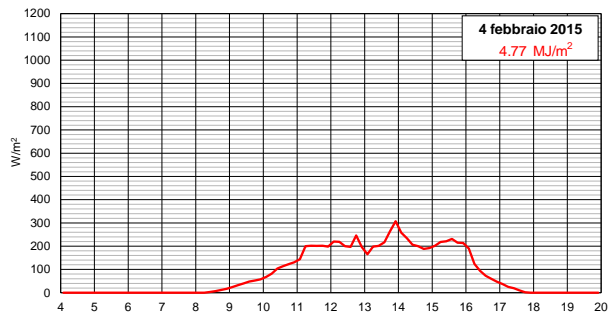
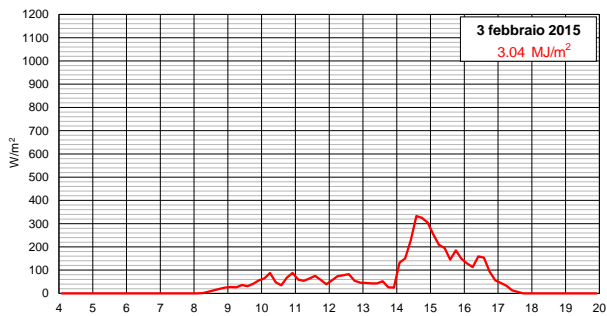
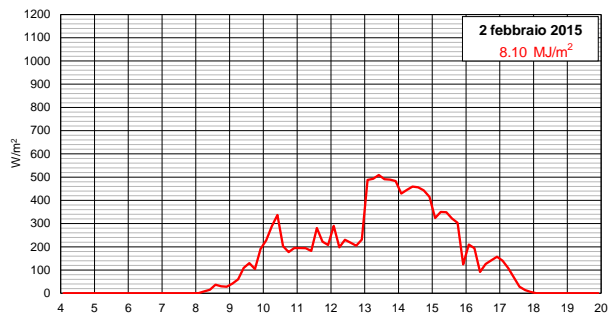
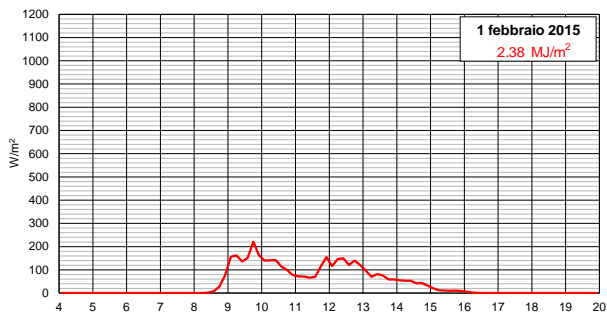
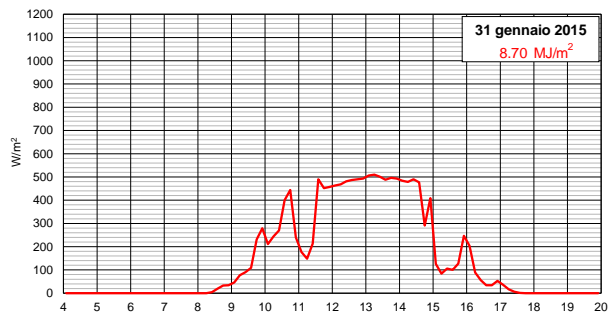
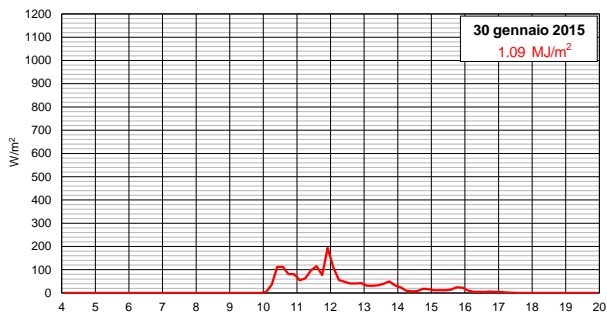
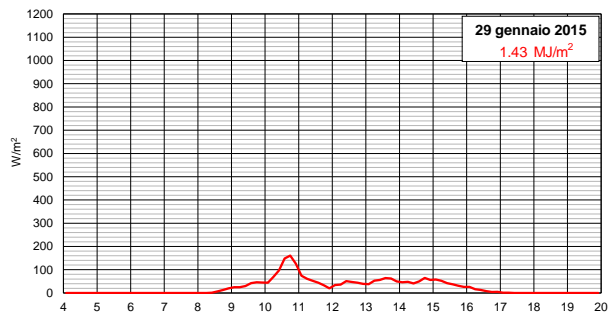
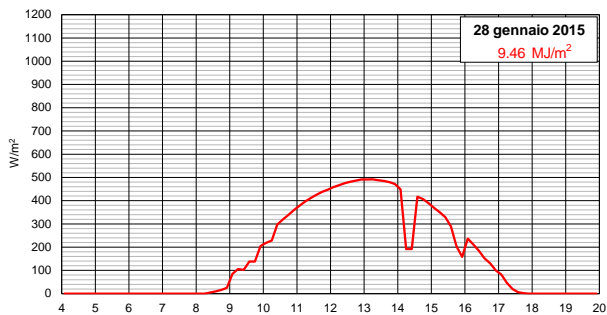
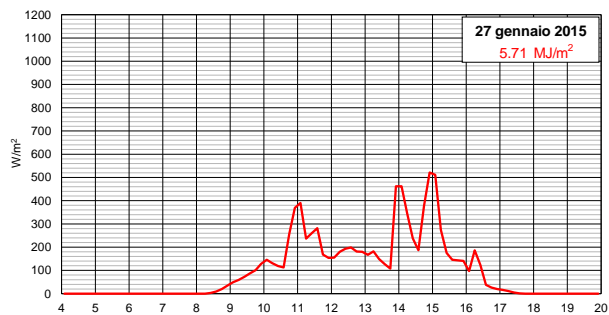
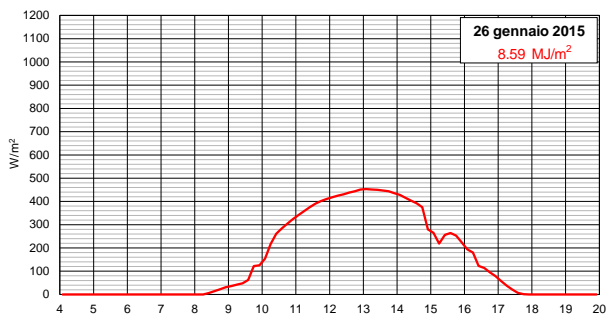
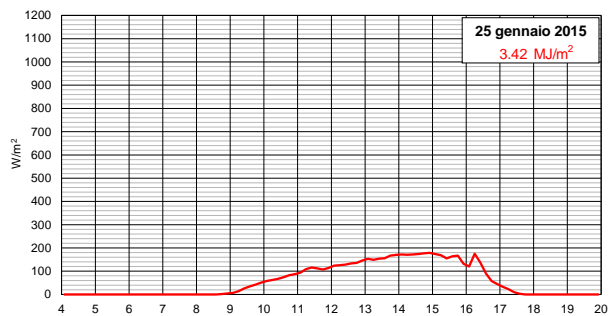
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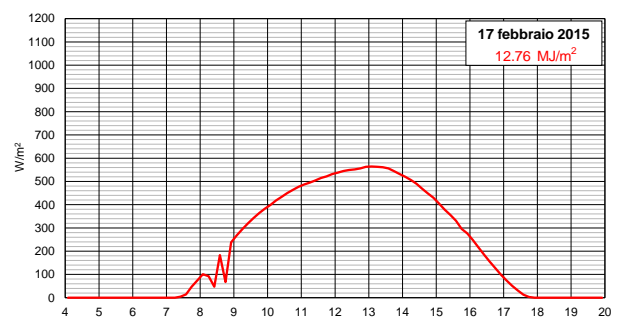
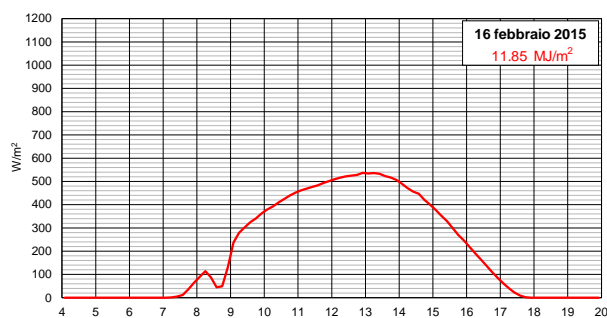
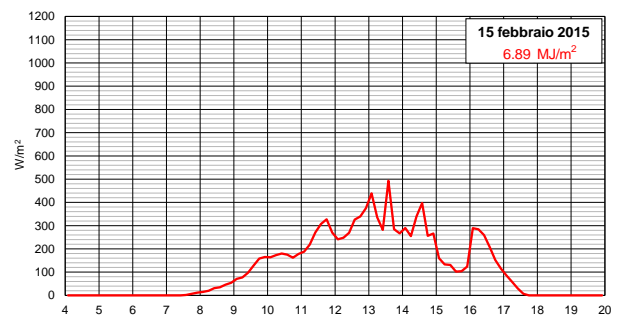
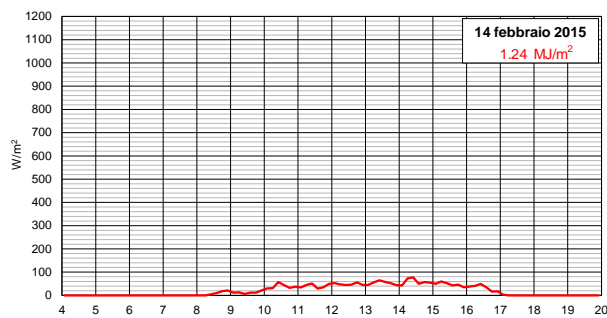
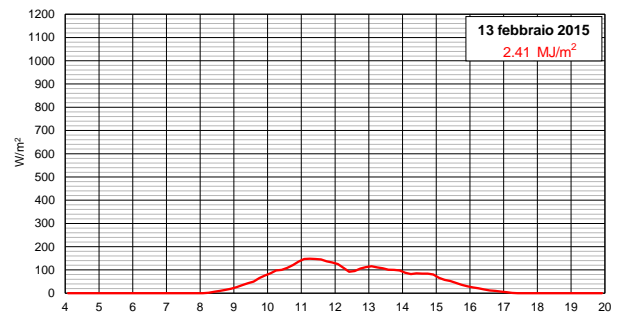
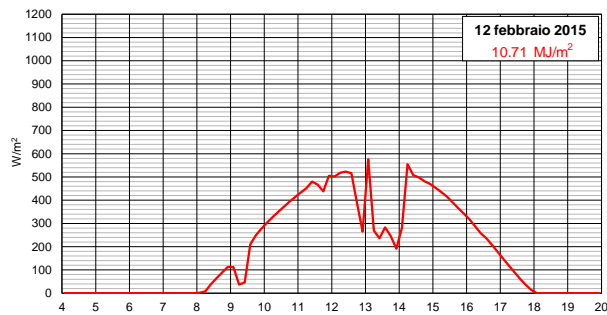
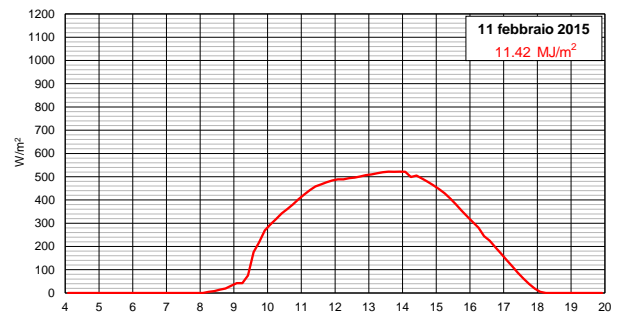
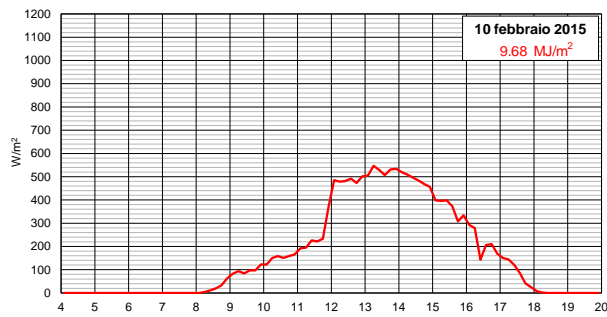
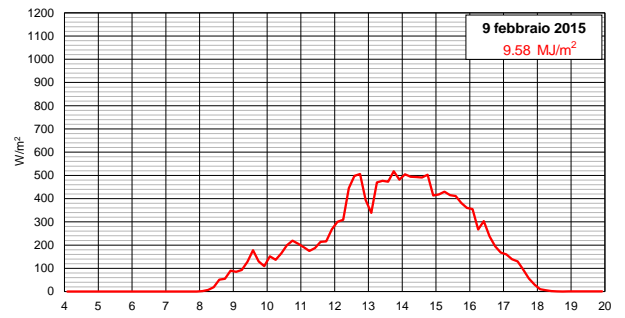
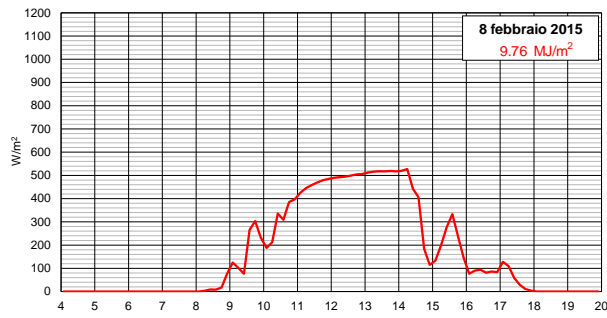
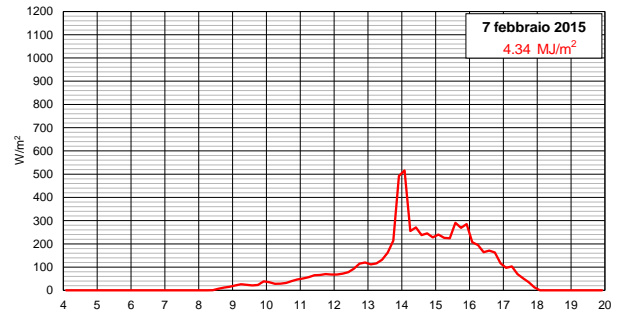
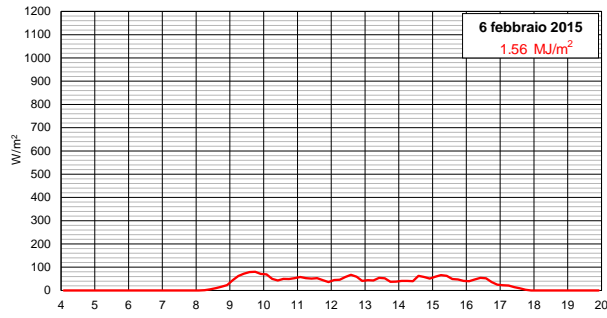
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	Irradiazione solare globale /(MJ/m ²)
GEN	137.91
FEB	217.92
MAR	364.61
APR	563.91
MAG	620.58
GIU	741.16
LUG	777.38
AGO	631.03
SET	443.87
OTT	271.36
NOV	174.00
DIC	106.89
anno	5050.60

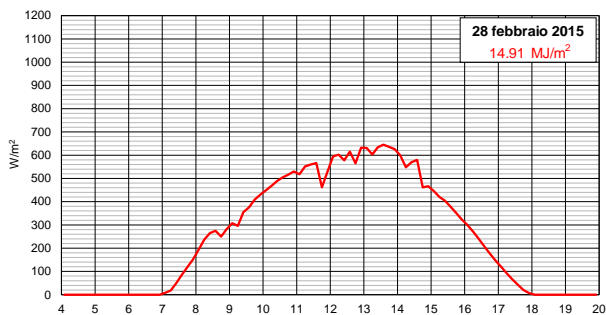
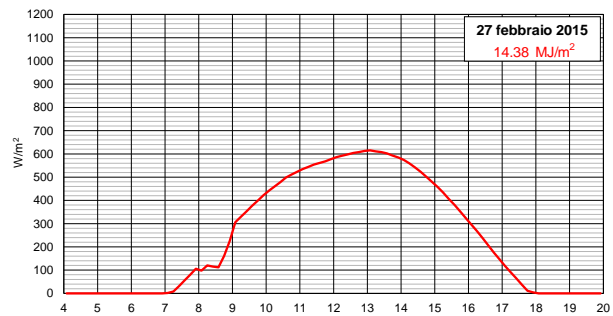
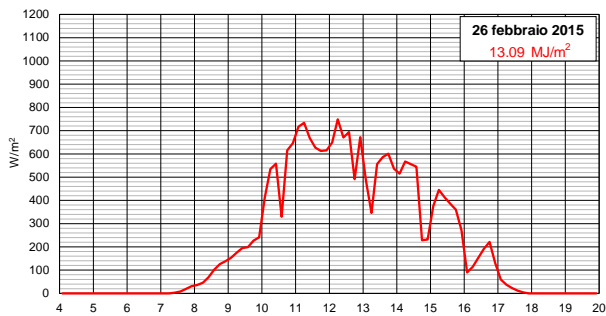
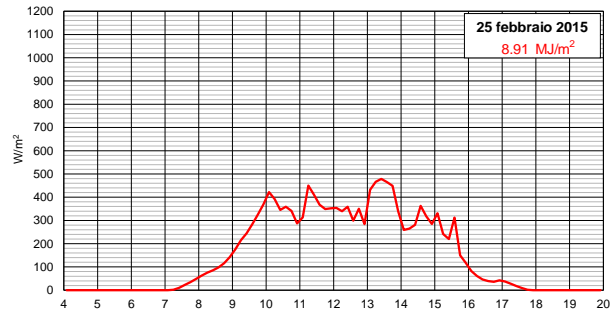
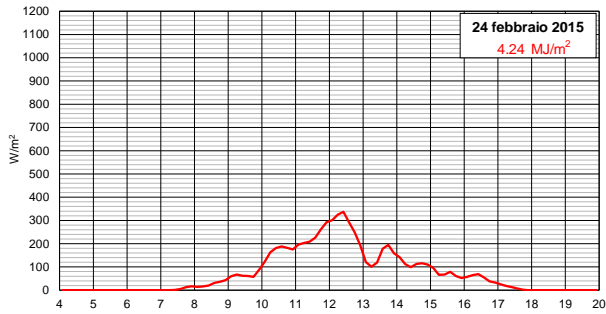
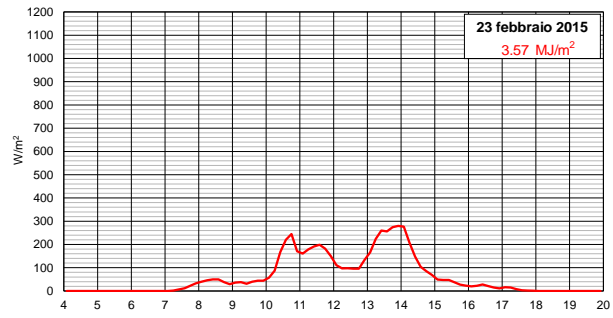
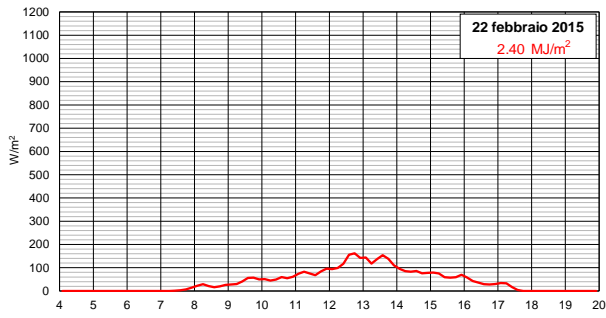
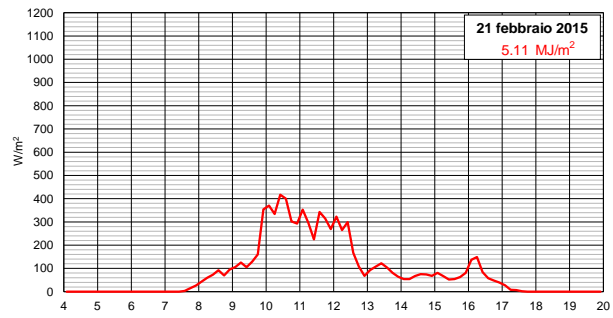
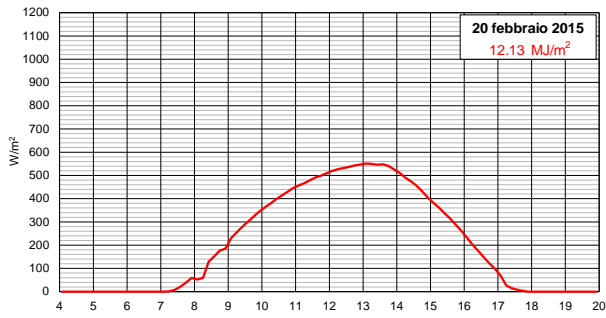
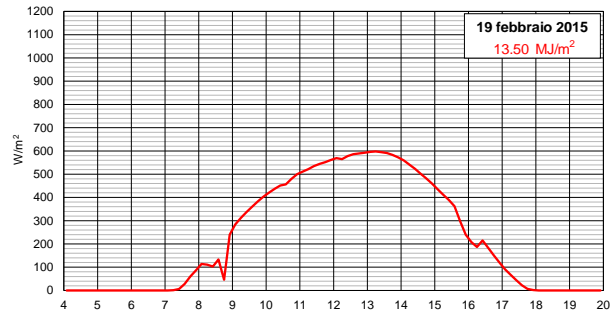
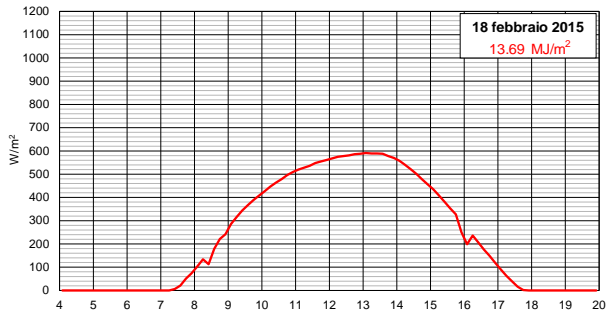
Università di Trieste, Dipartimento di Matematica e Geoscienze Stazione meteorologica di TRIESTE Valori normali 2001 – 2010				
	Irradiazione solare /(MJ/m ²)		Rapporto d/g	Eliofania /h
	globale	diffusa	%	
GEN	138.74	58.79	42.4	102.9
FEB	206.51	85.64	41.5	125.6
MAR	352.30	151.09	42.9	160.9
APR	479.66	190.69	39.8	195.7
MAG	626.73	236.07	37.7	266.7
GIU	674.76	248.10	36.8	274.4
LUG	719.98	224.72	31.2	319.3
AGO	606.89	198.66	32.7	287.3
SET	438.81	158.46	36.1	216.9
OTT	274.07	114.28	41.7	146.1
NOV	142.92	66.94	46.8	99.6
DIC	120.63	49.84	41.3	103.7
anno	4782.01	1783.28	37.3	2299.0

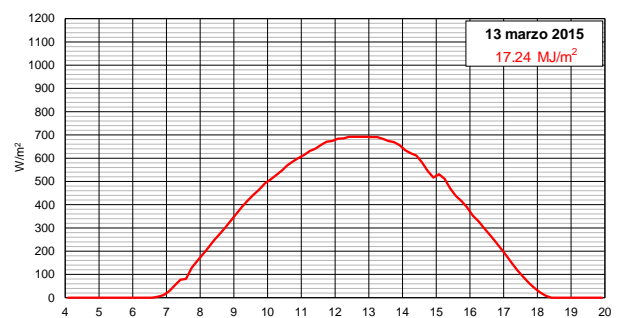
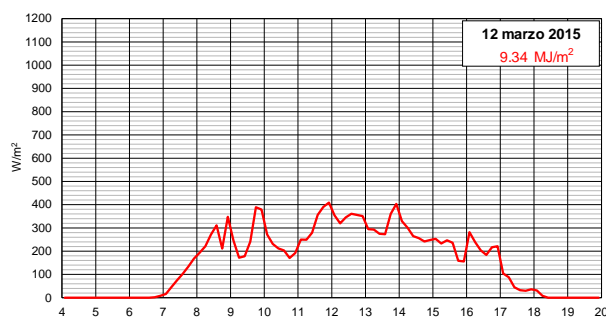
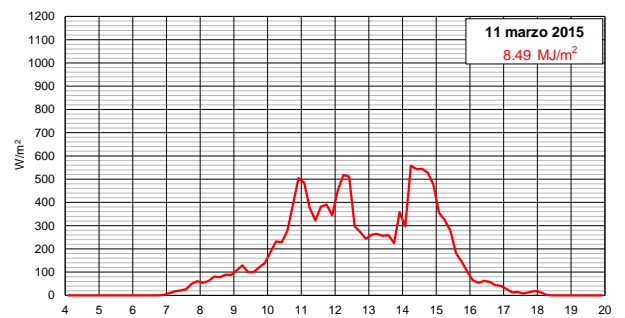
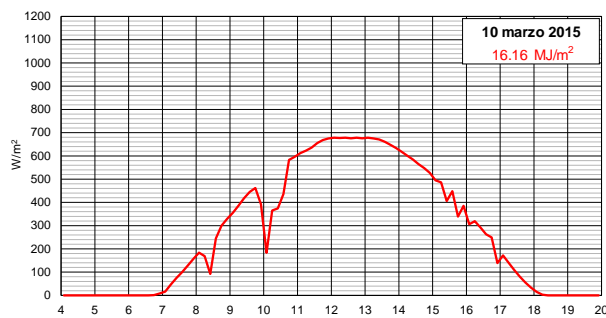
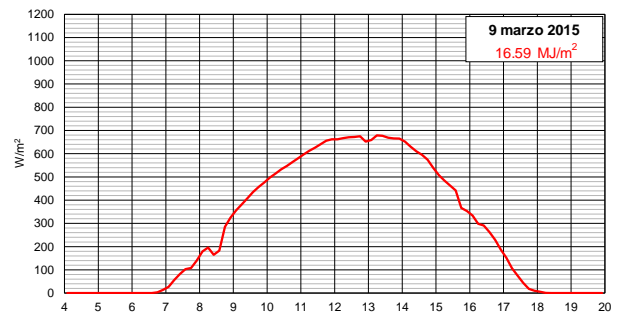
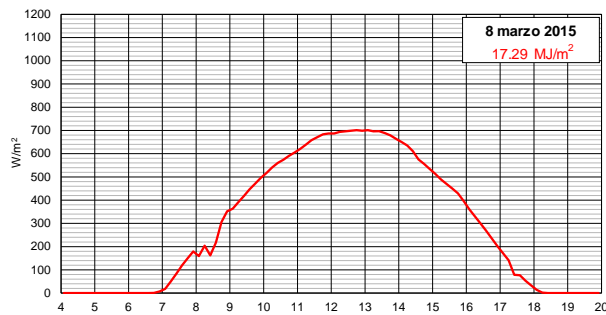
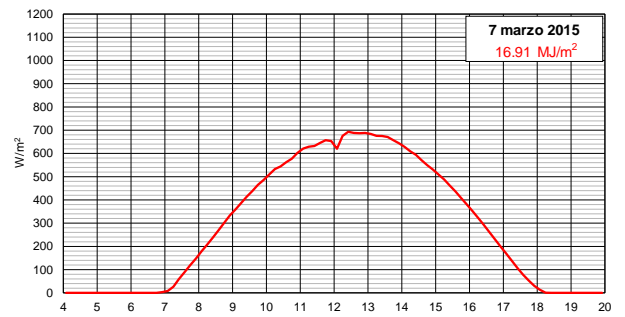
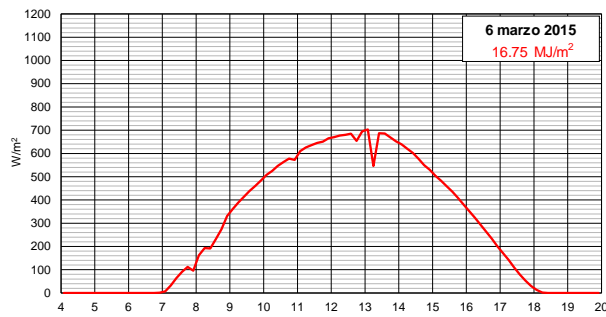
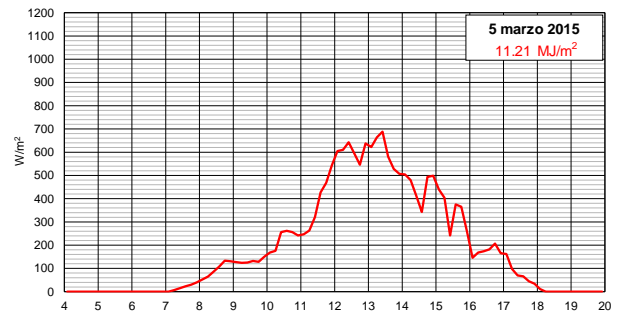
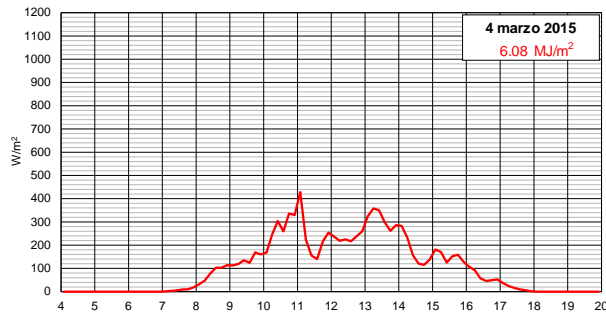
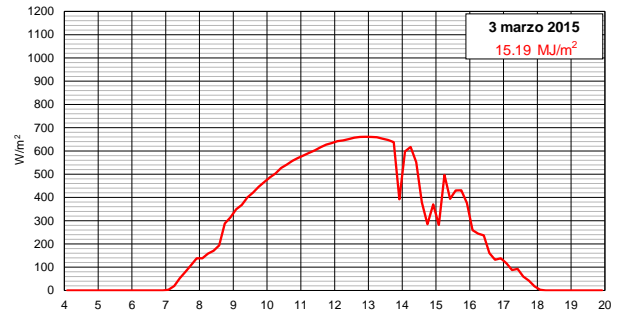
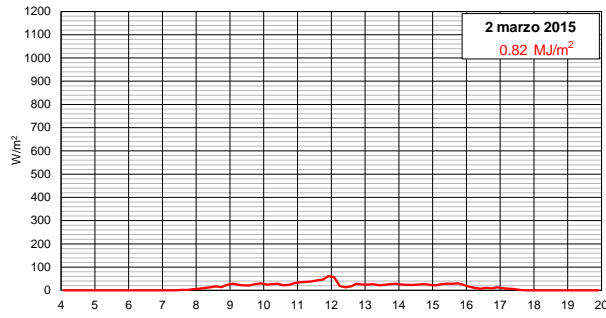


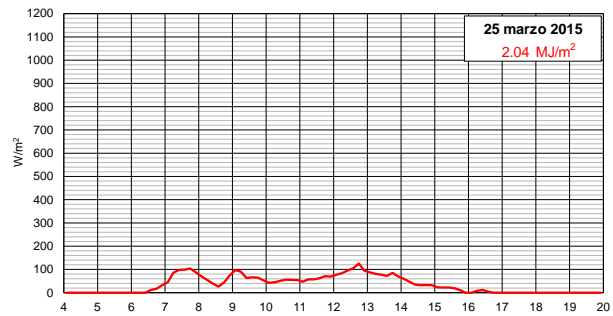
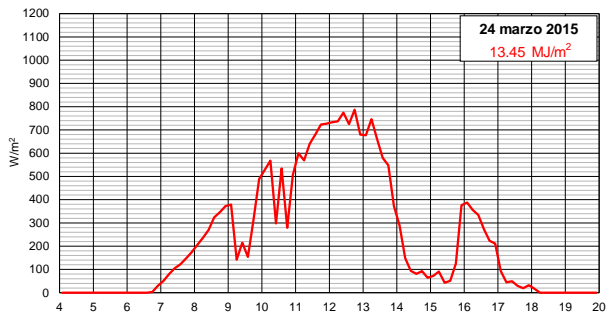
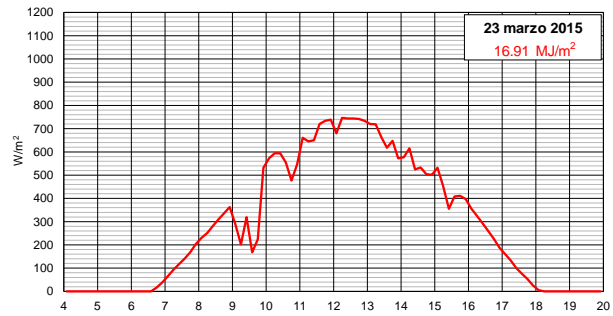
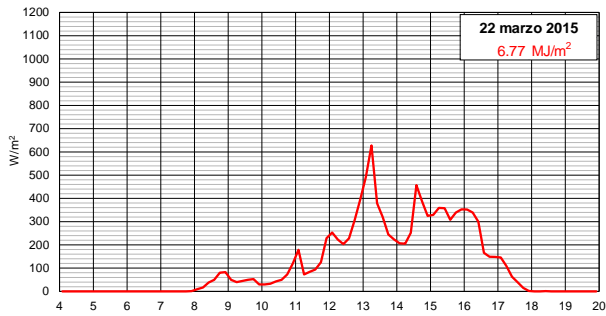
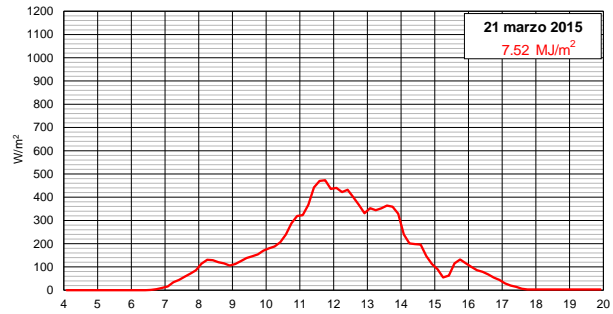
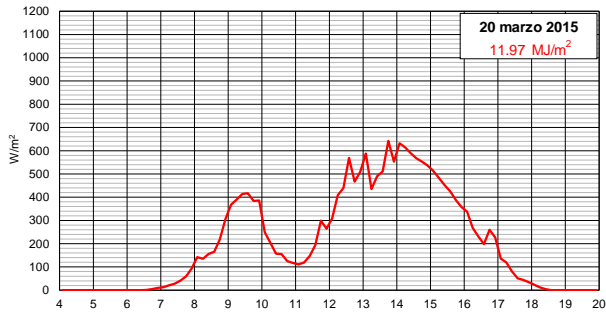
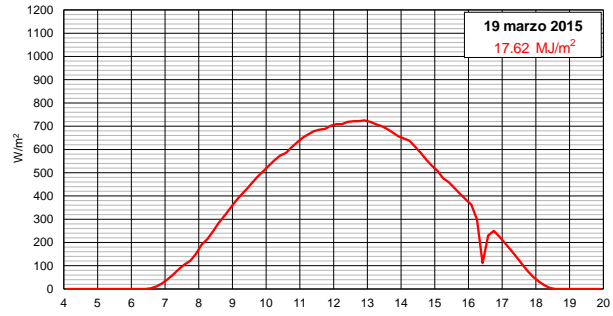
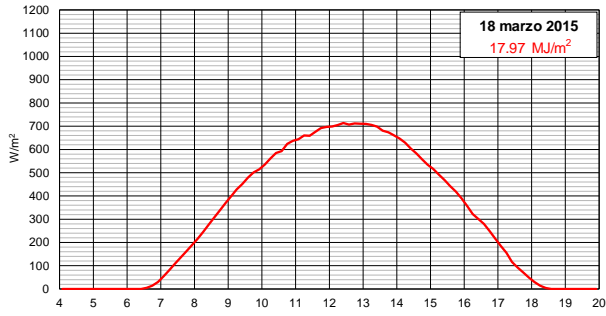
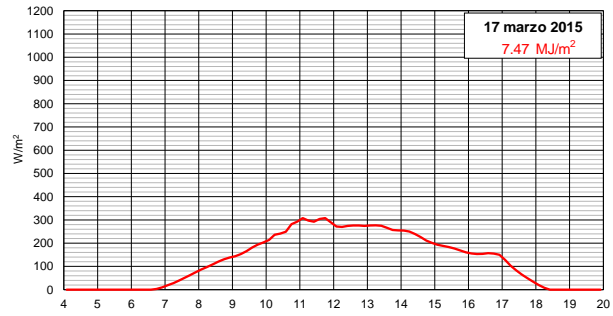
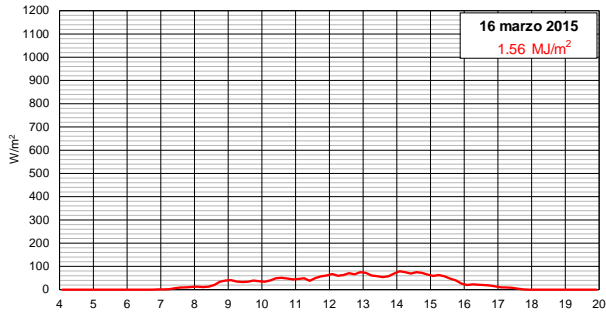
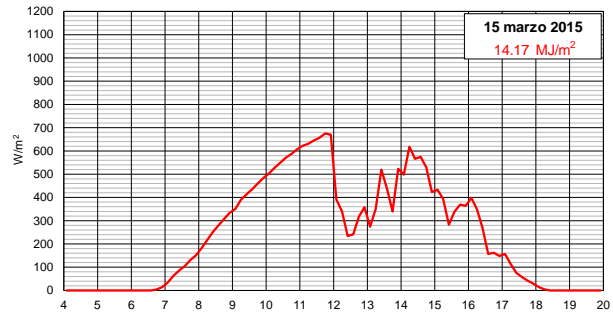
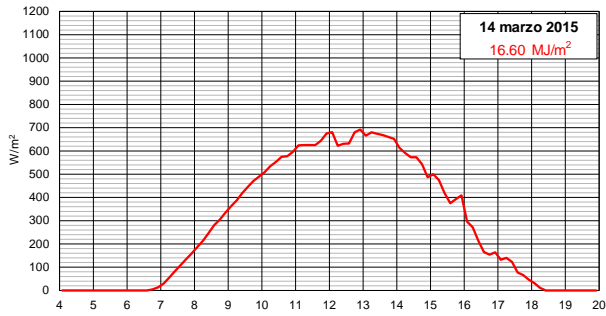


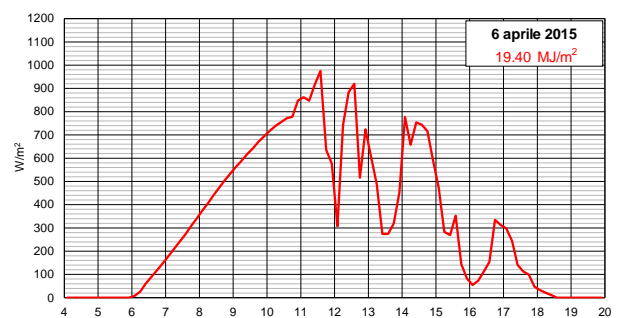
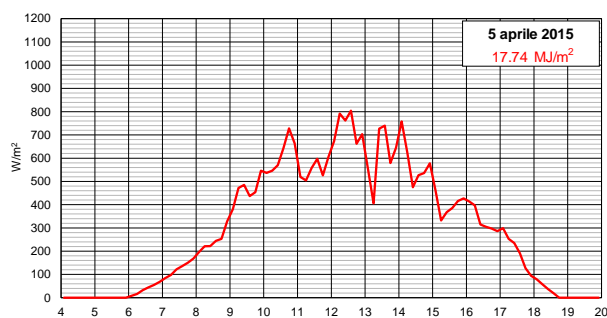
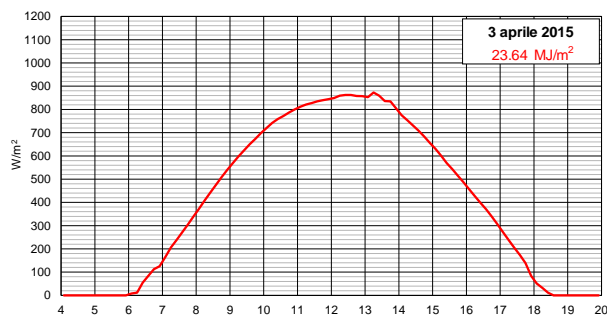
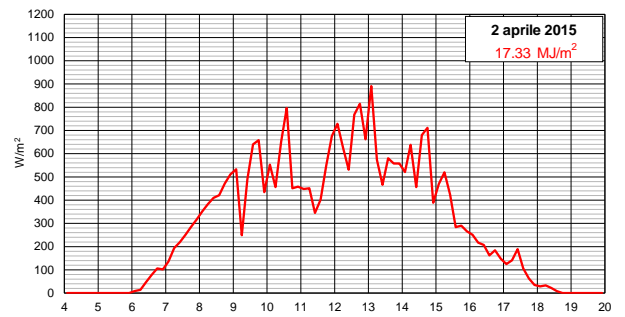
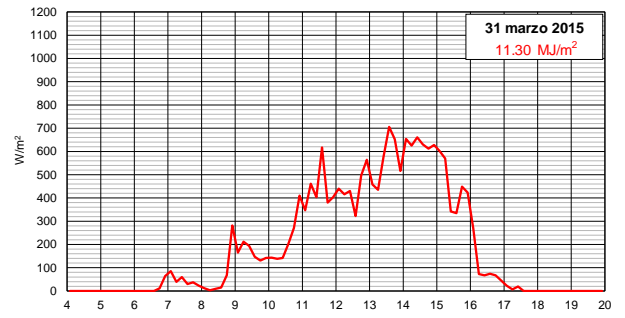
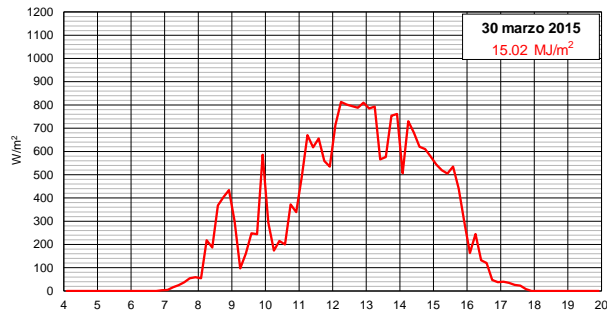
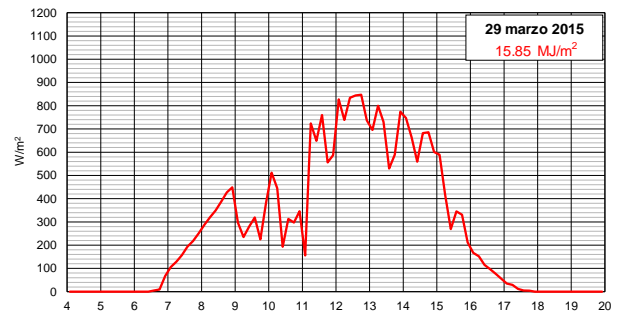
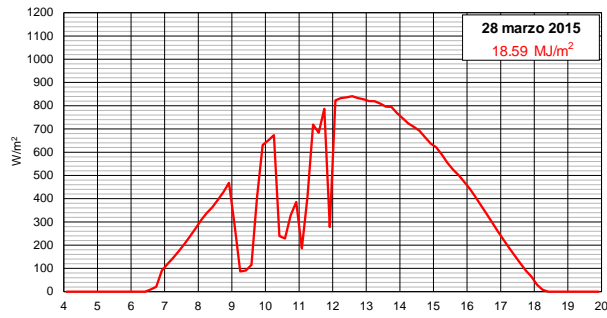
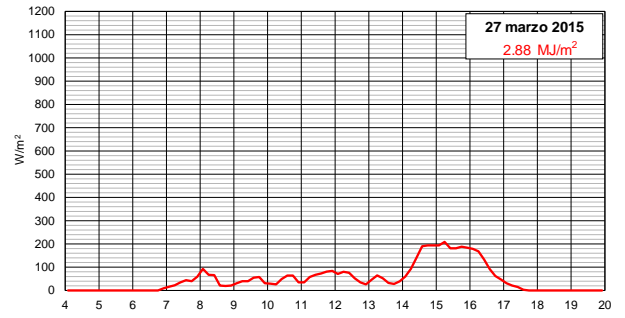
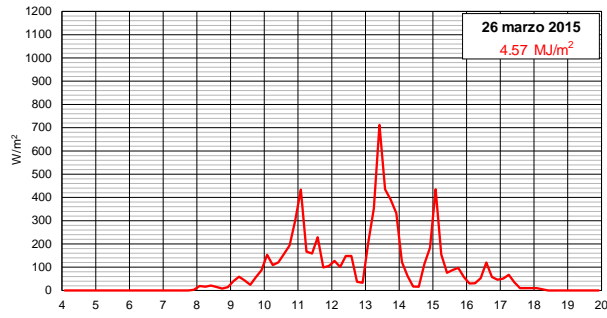


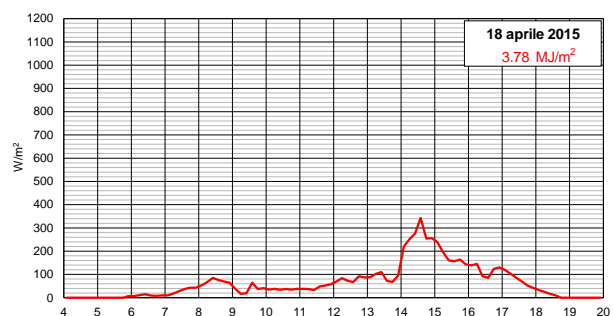
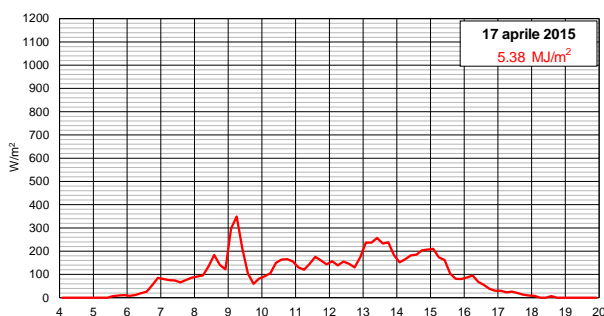
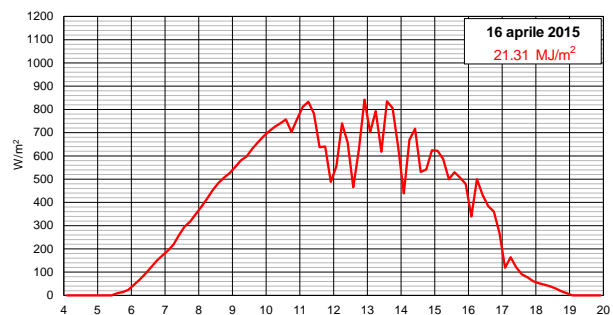
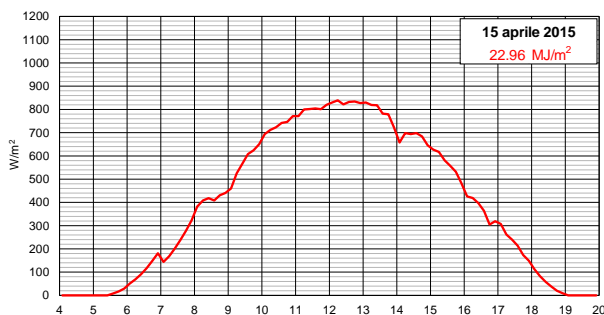
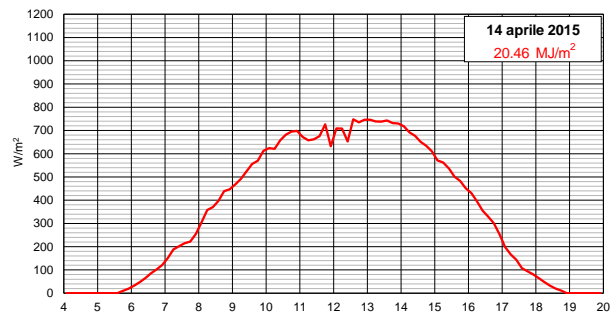
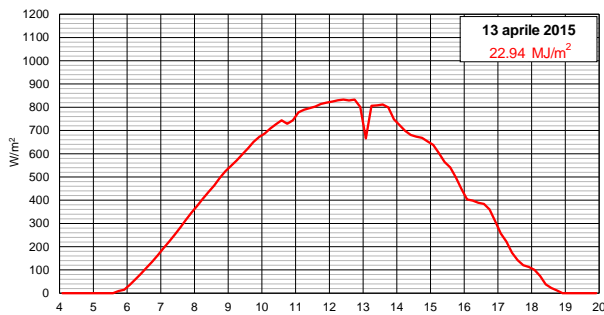
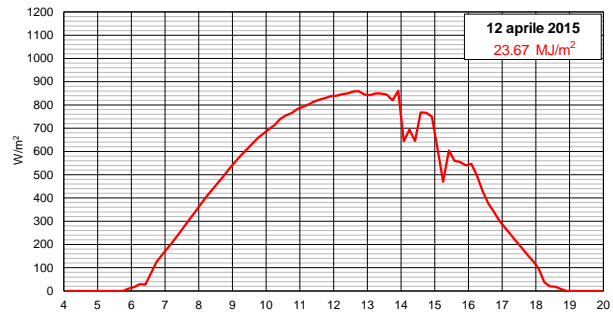
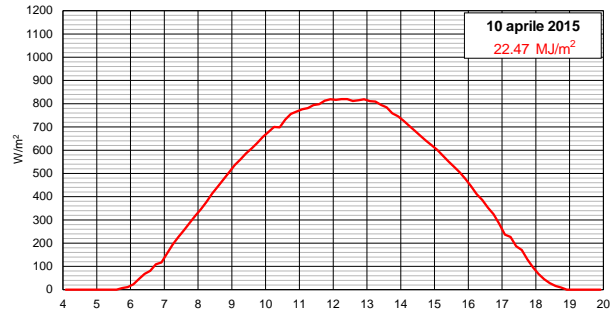
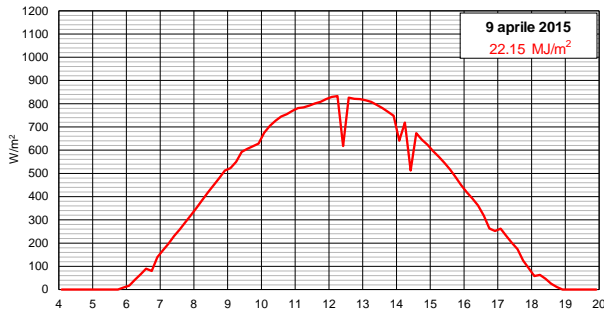
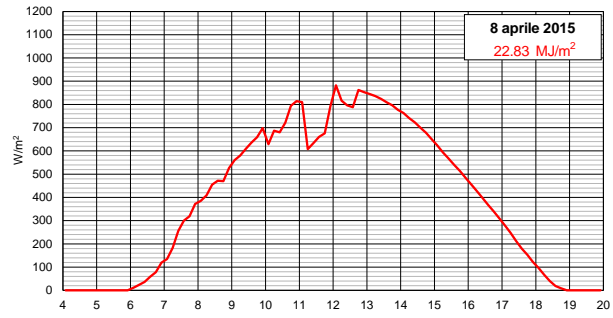
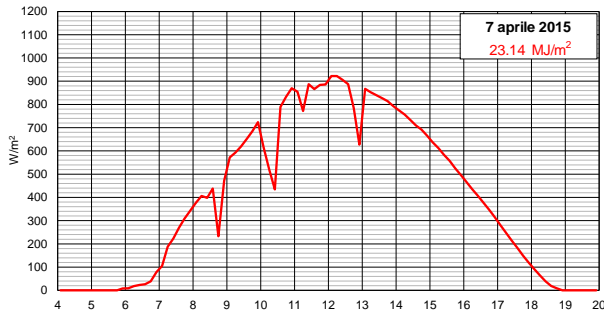


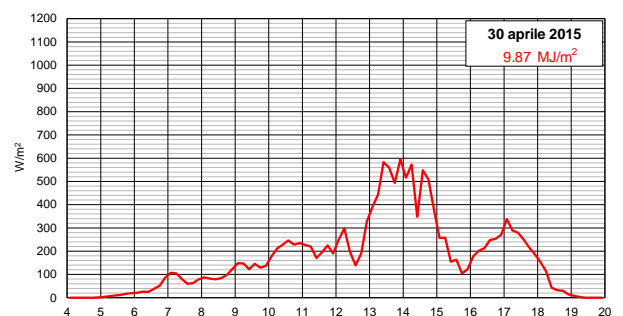
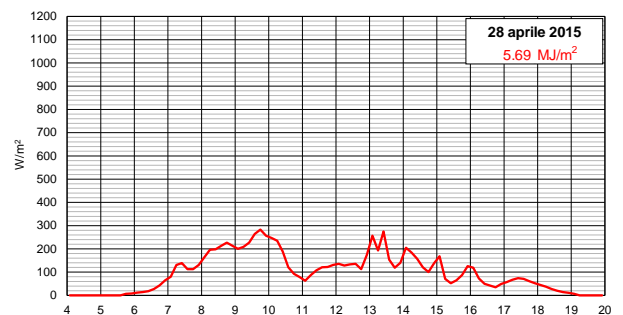
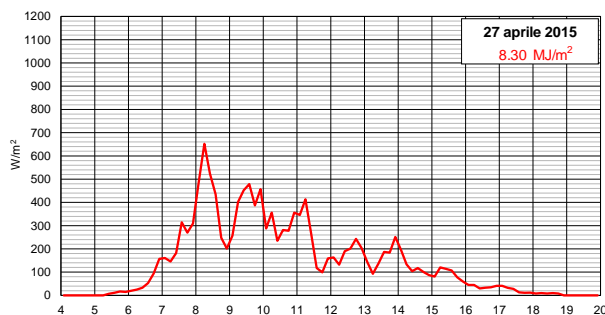
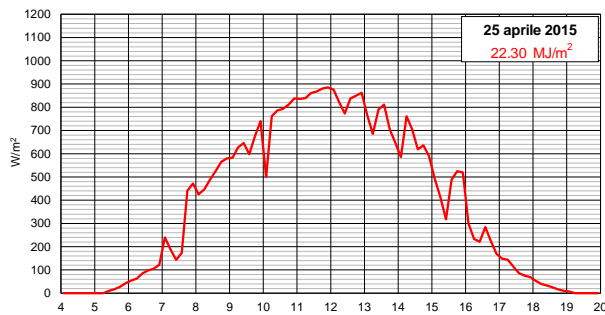
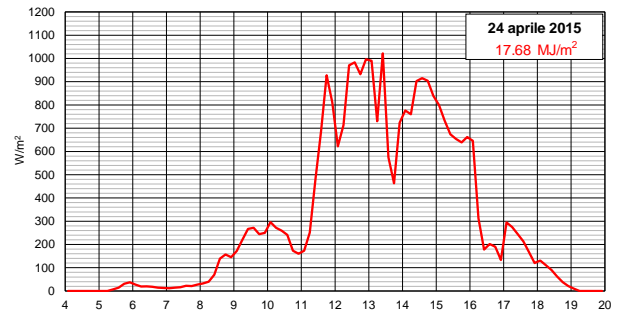
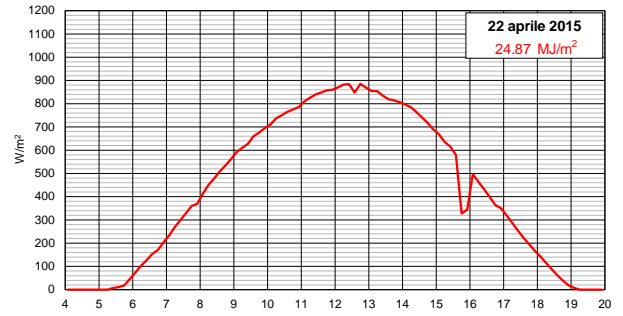
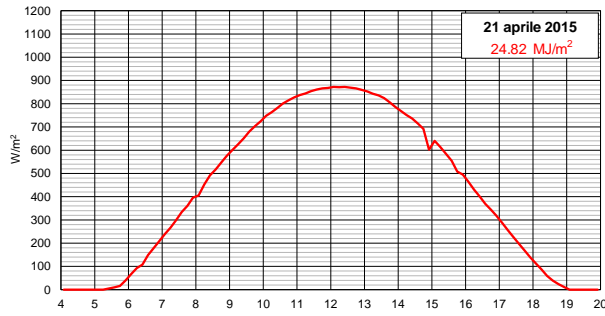
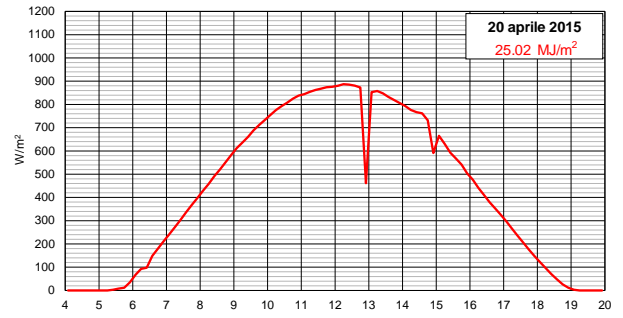
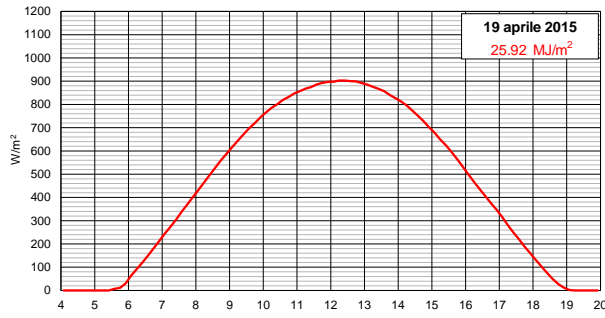


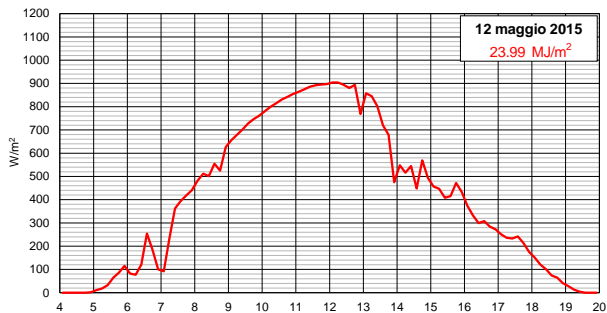
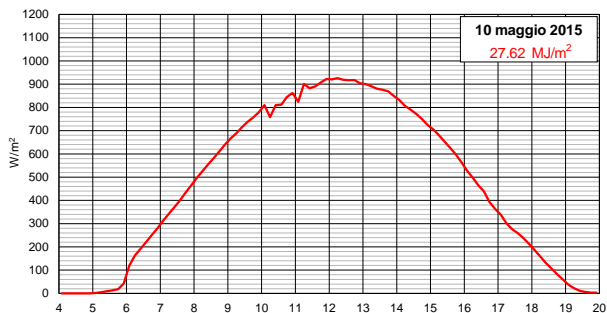
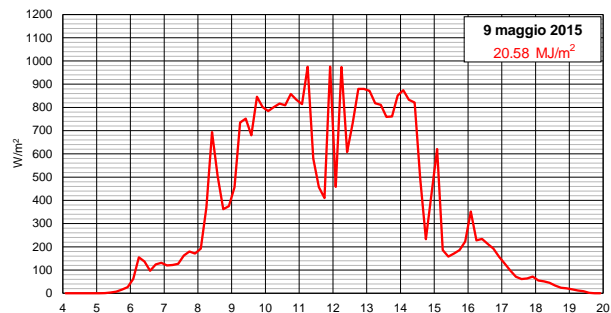
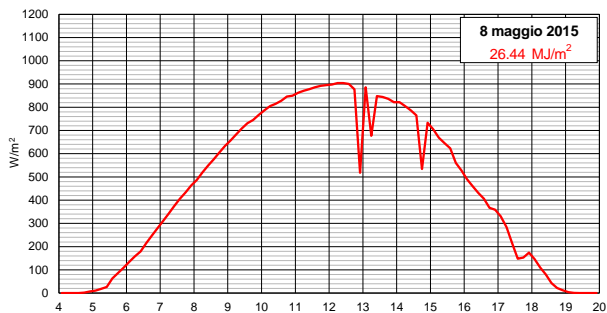
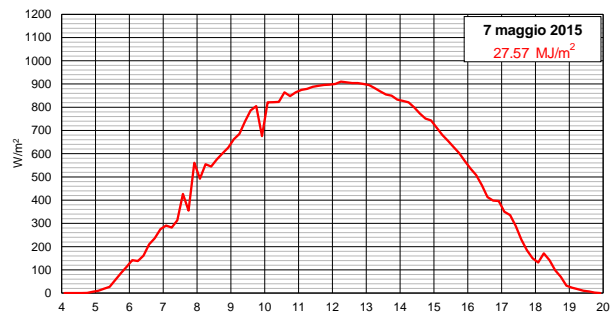
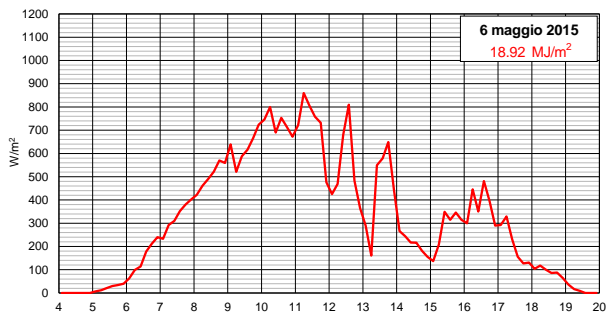
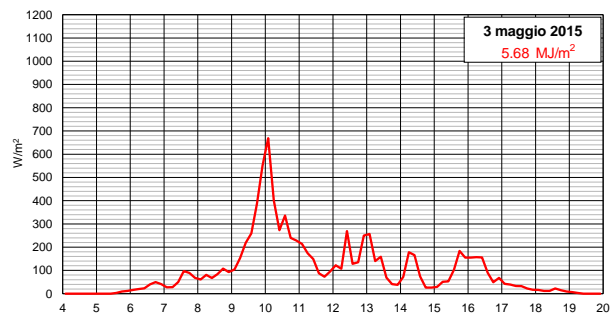
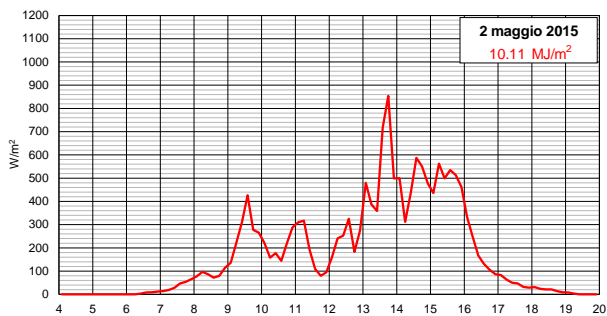
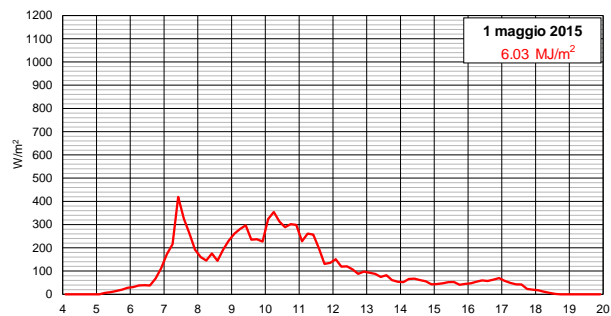


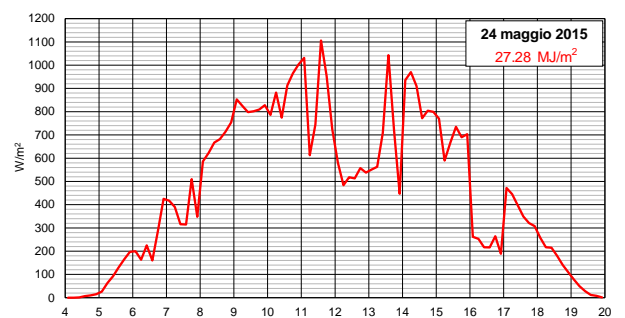
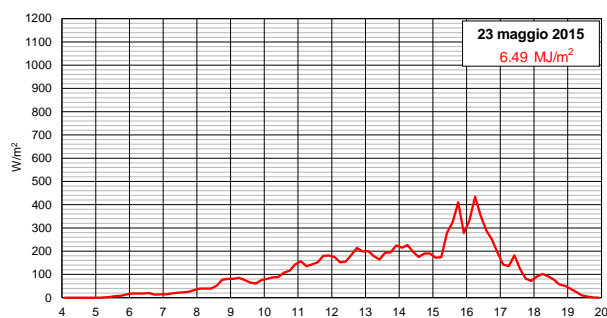
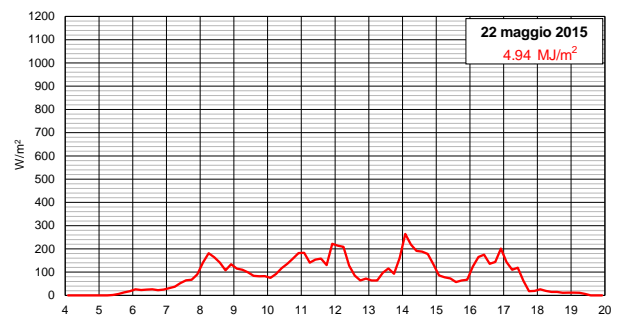
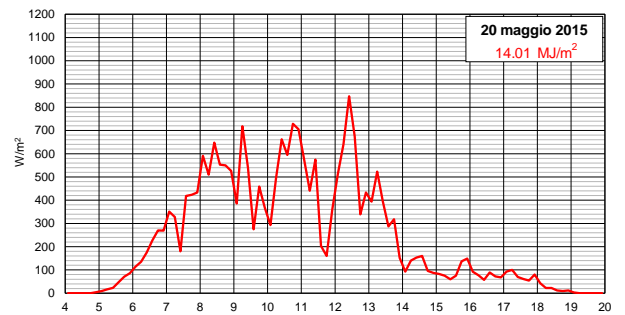
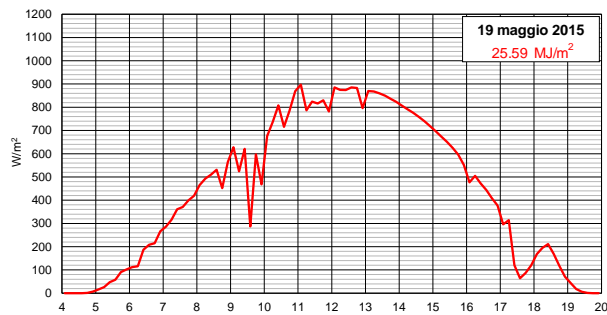
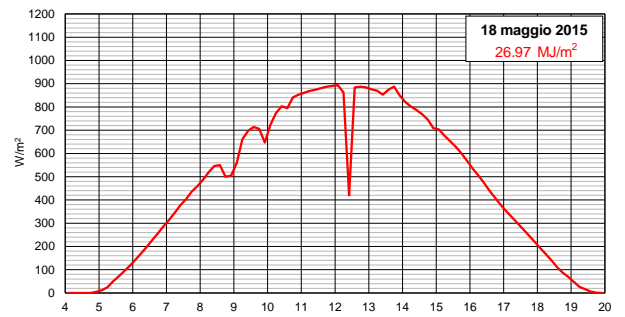
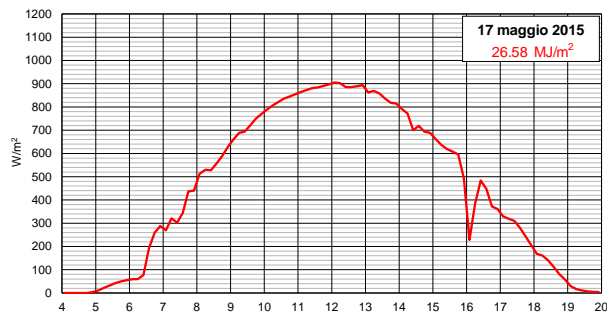
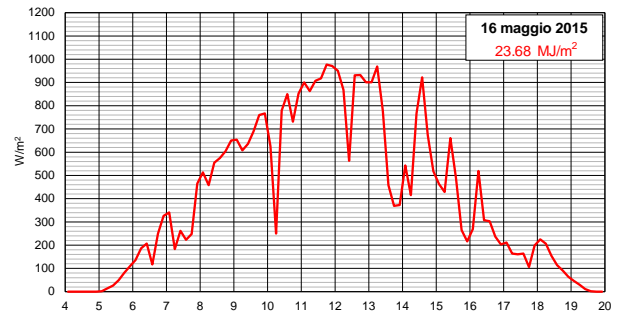
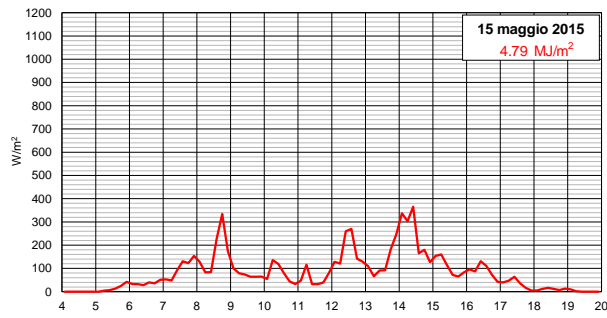
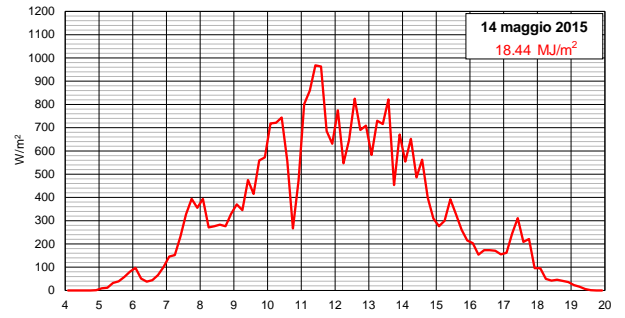
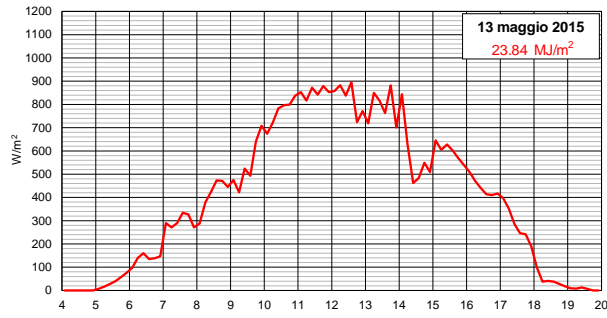


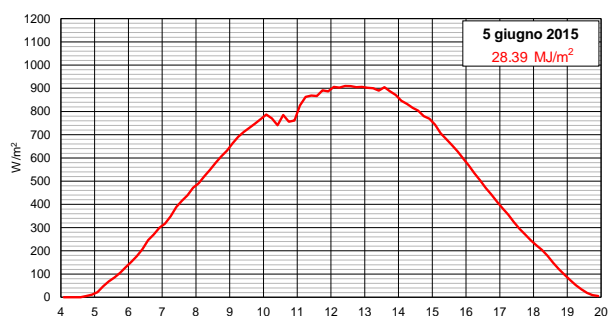
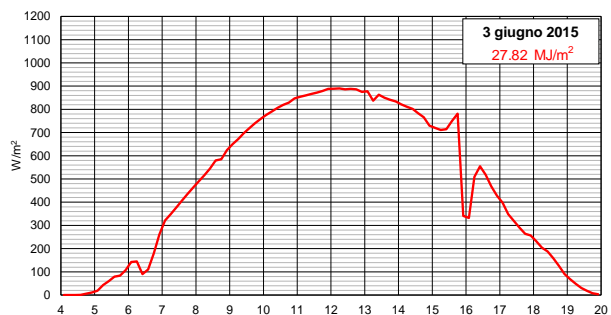
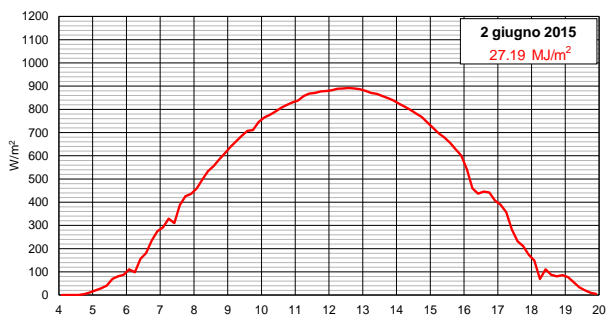
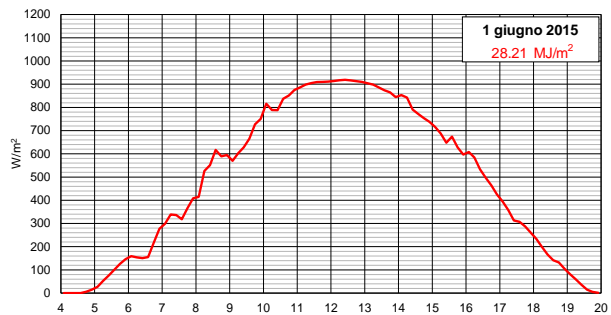
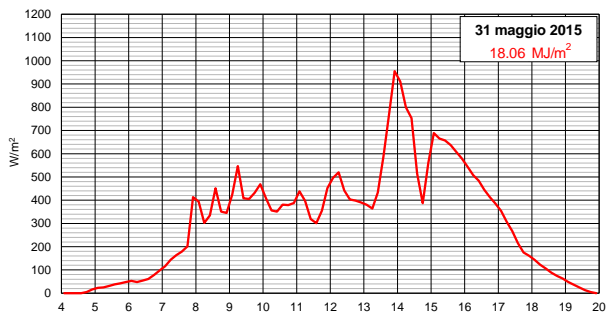
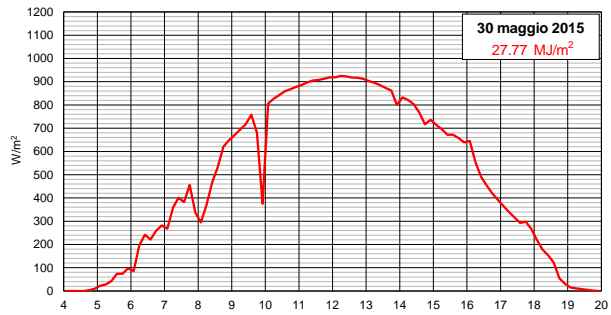
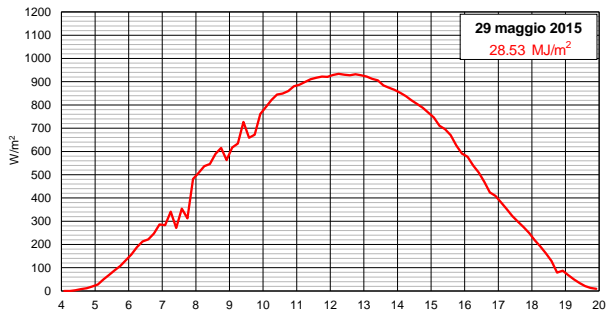
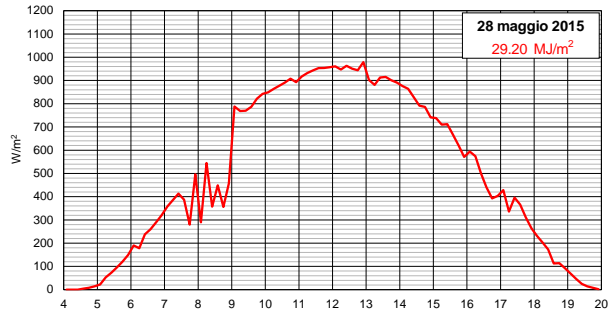
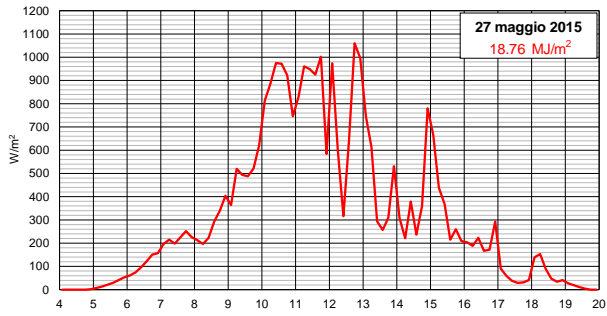
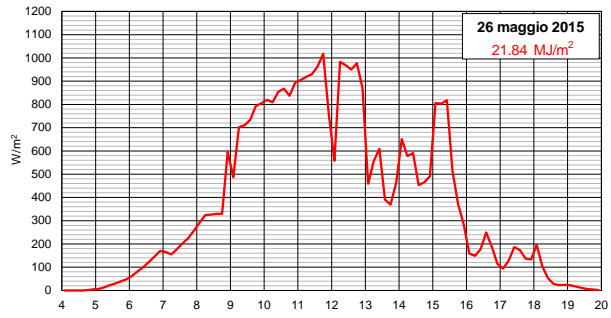
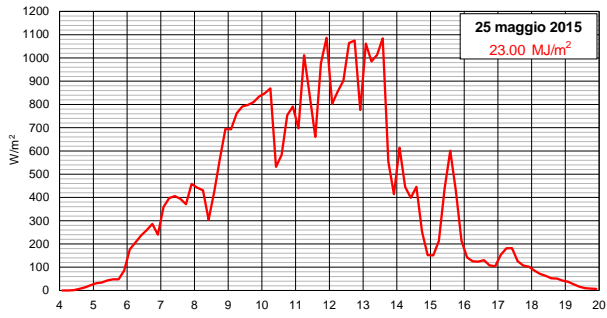


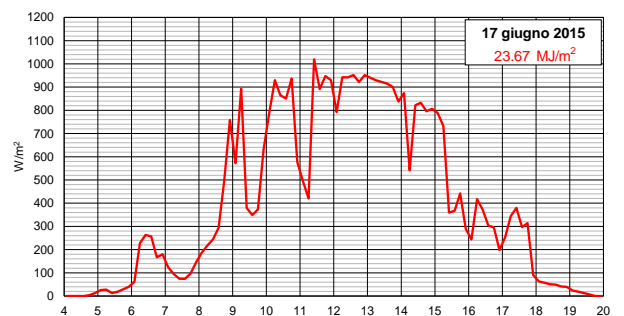
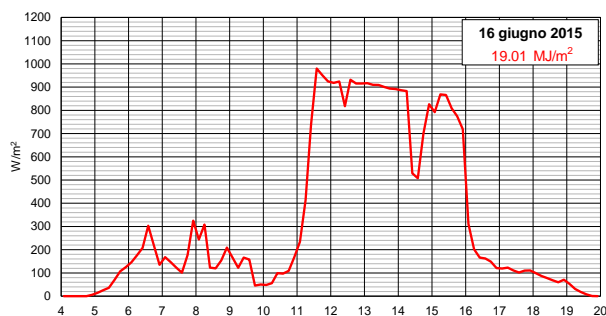
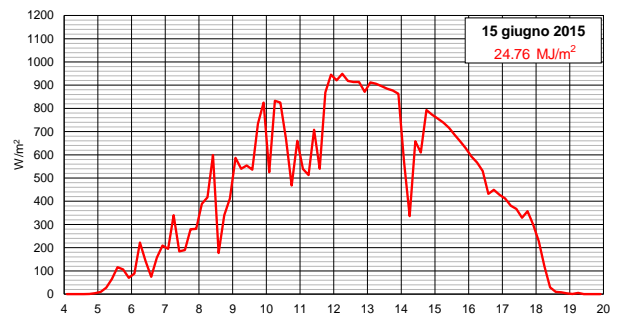
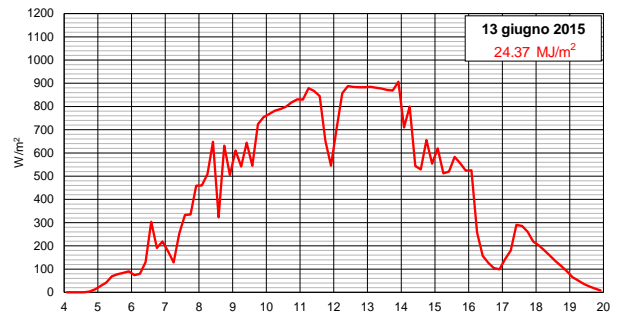
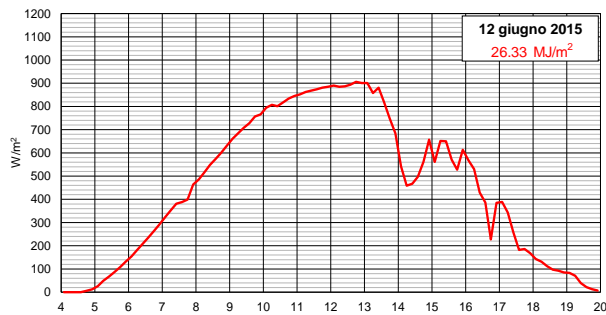
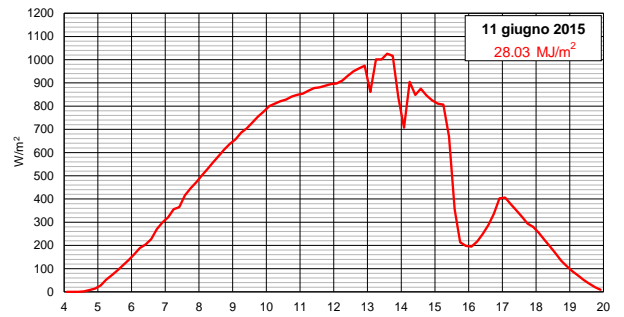
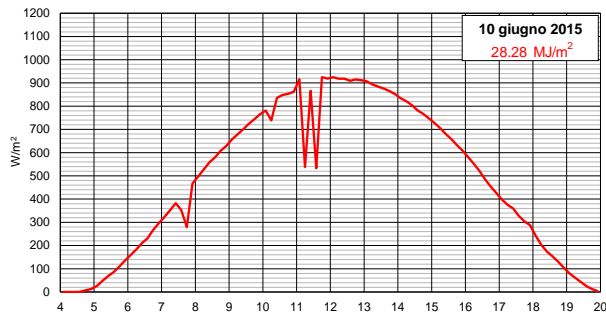
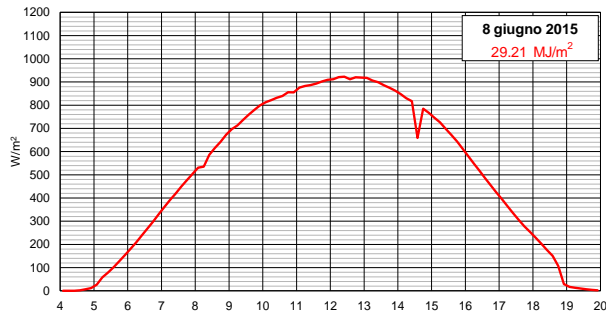
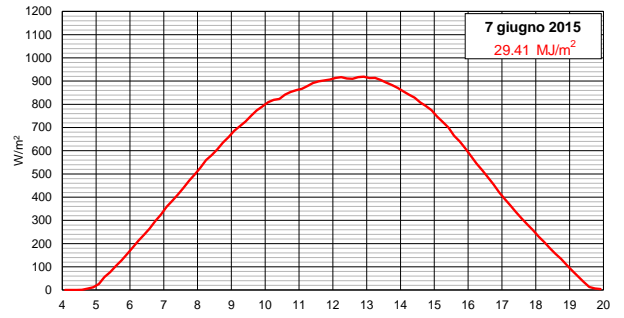
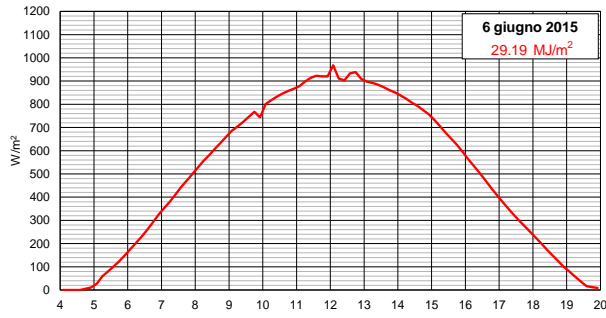


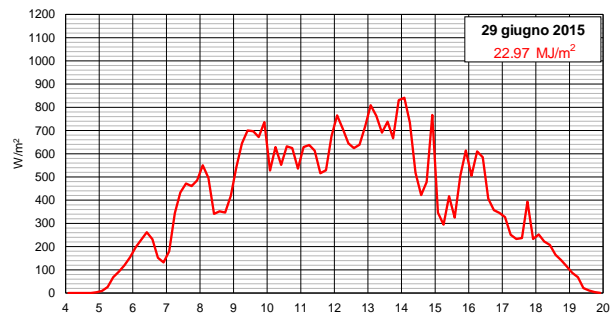
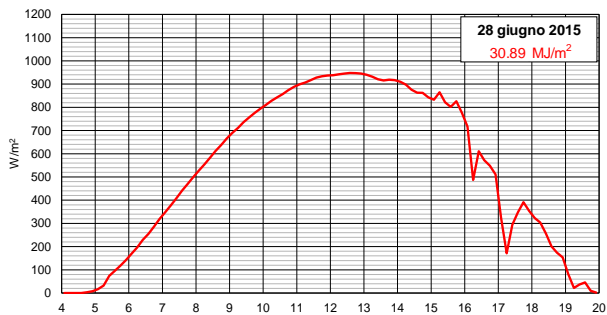
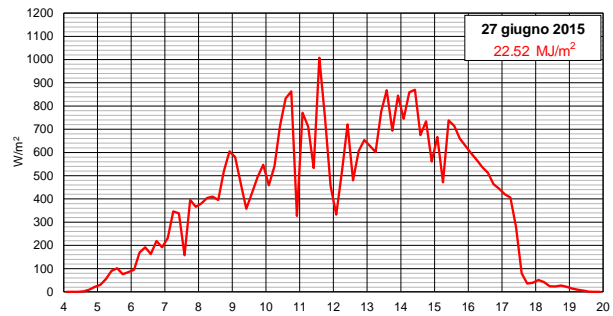
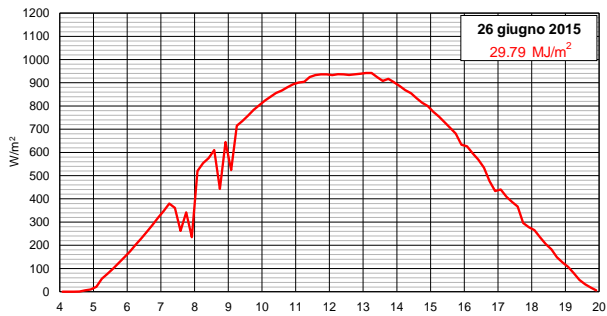
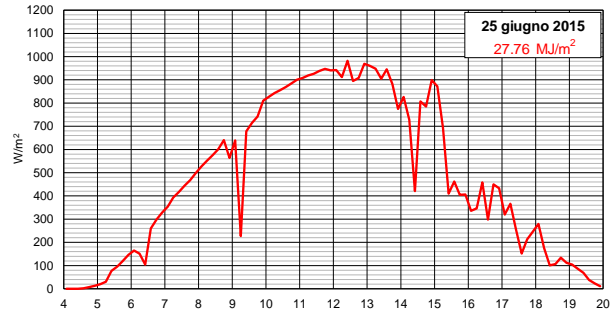
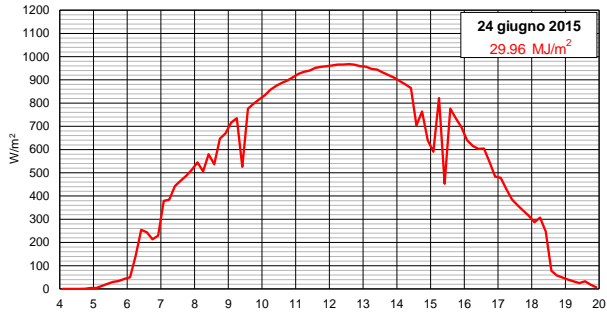
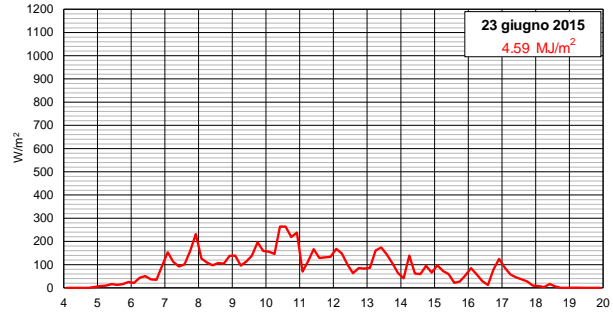
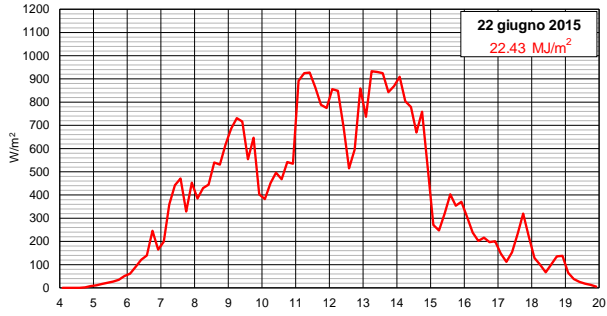
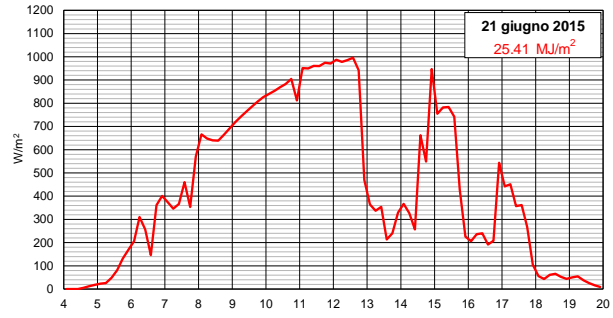
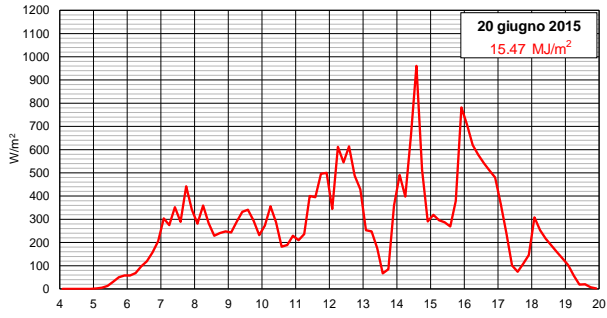
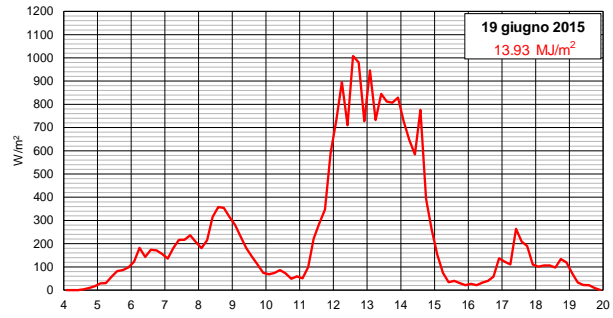
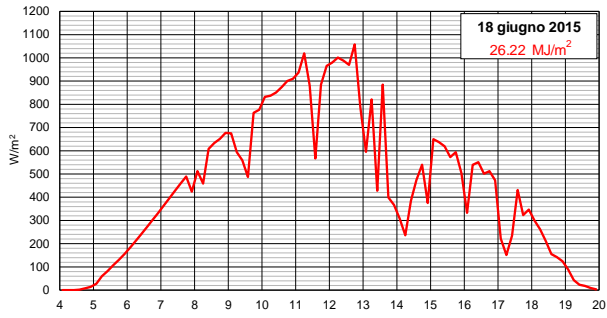


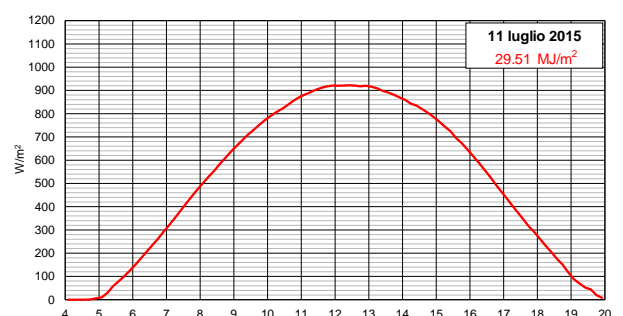
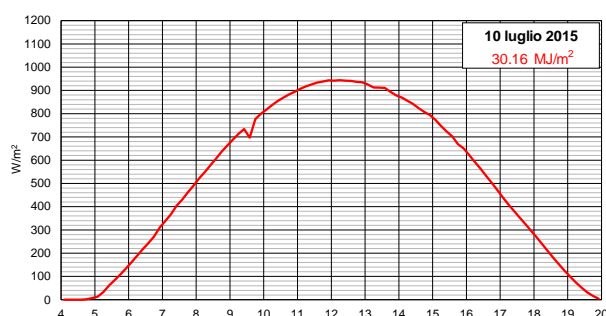
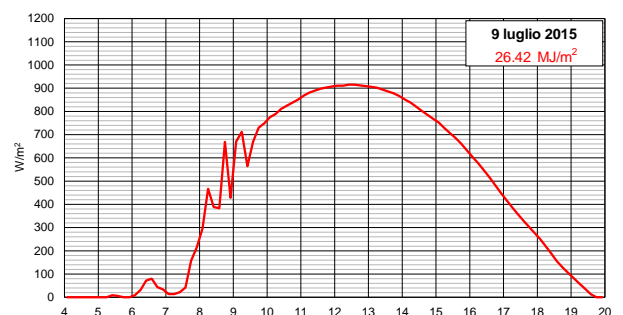
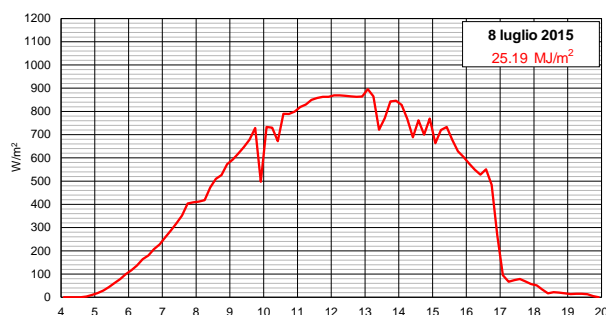
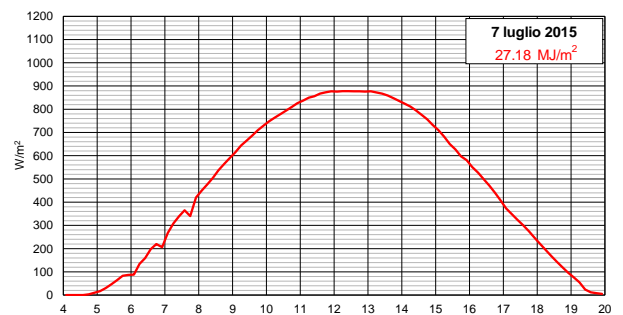
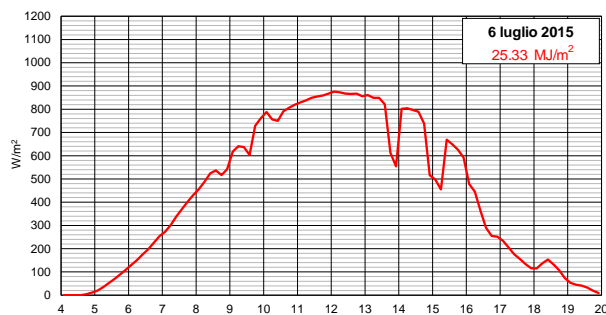
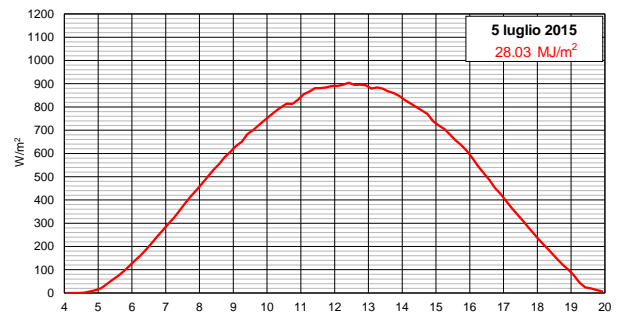
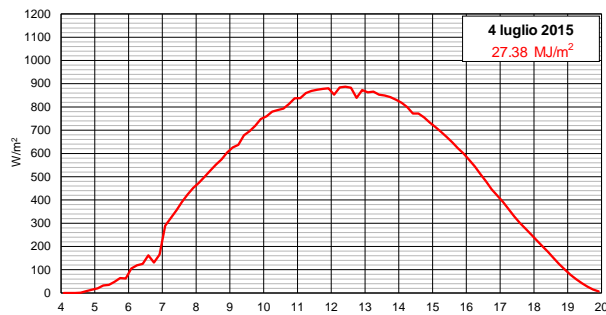
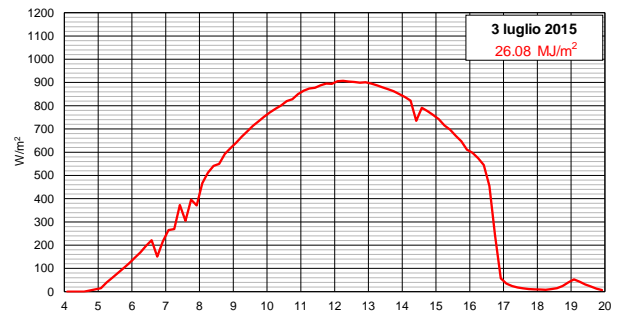
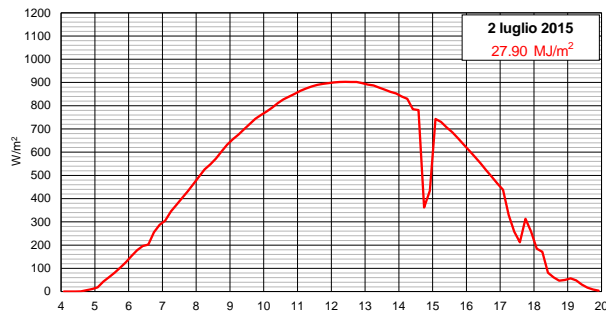
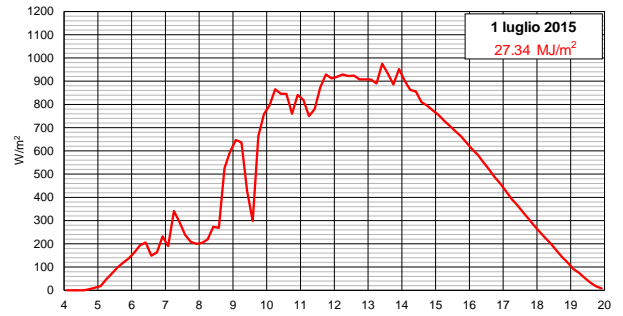
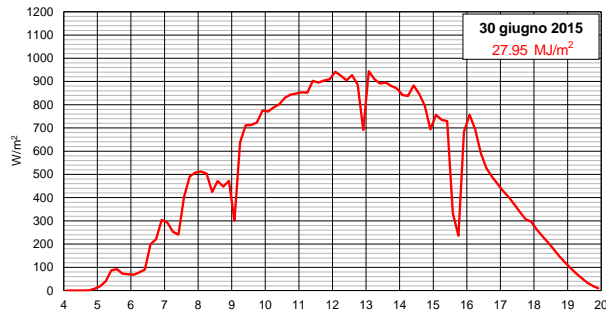


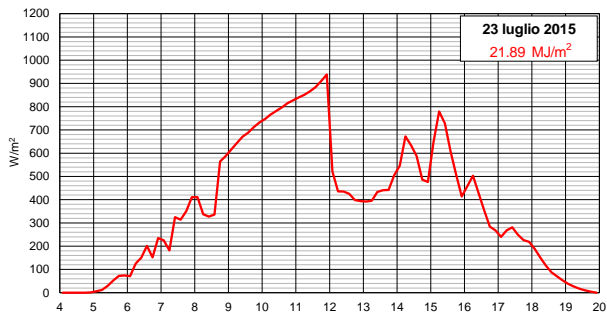
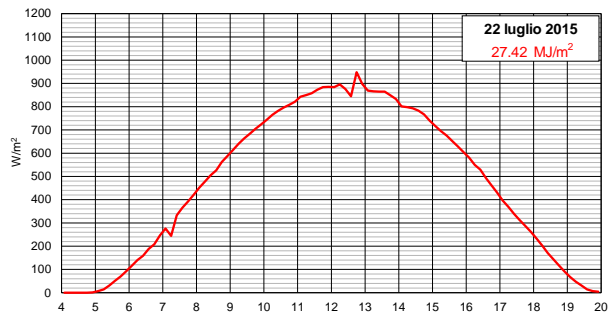
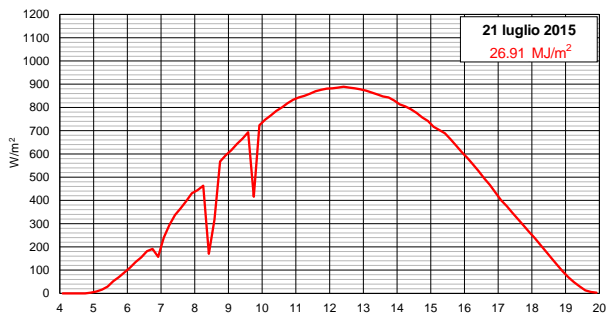
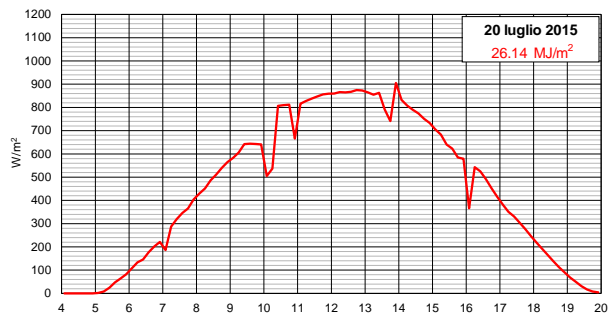
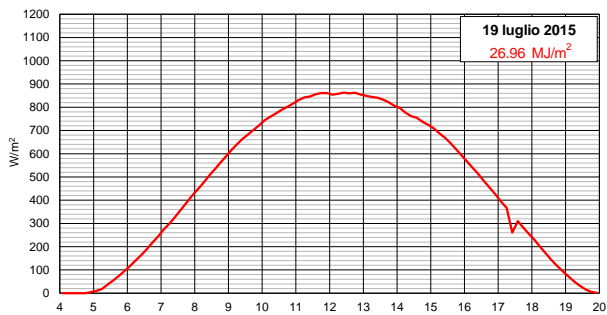
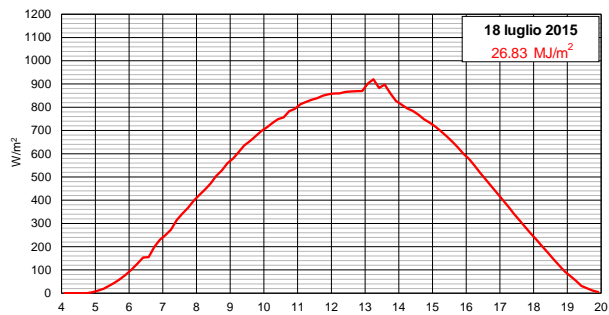
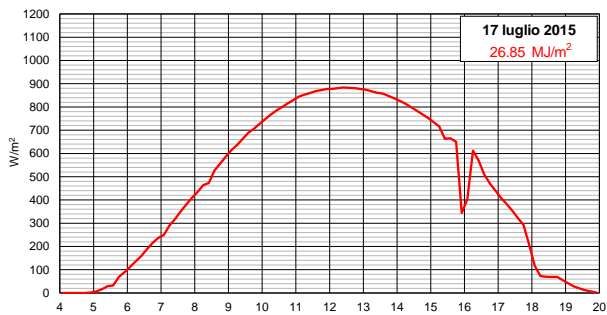
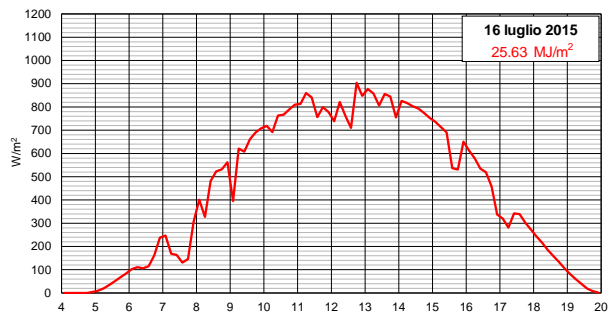
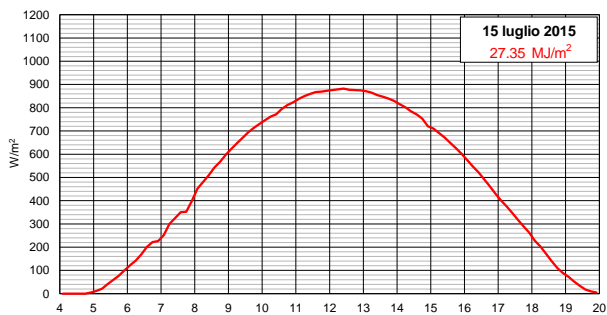
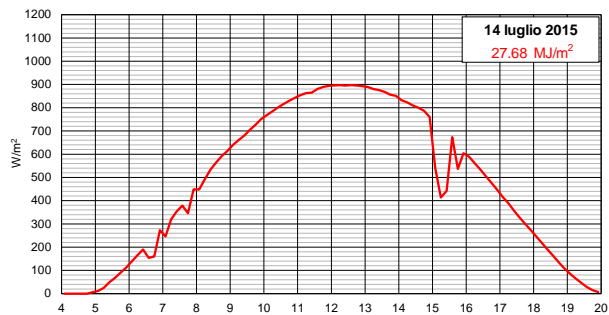
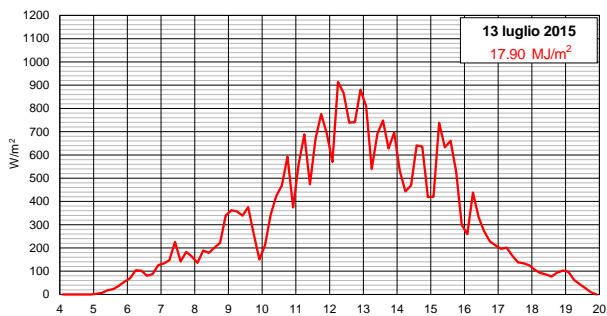
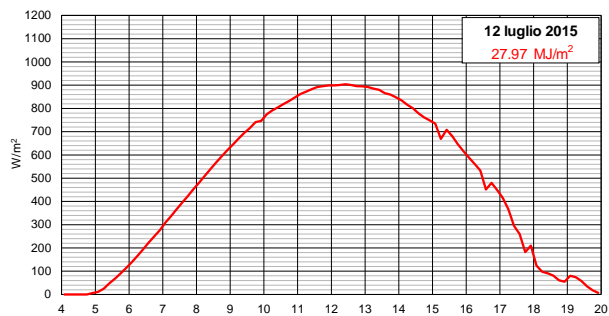


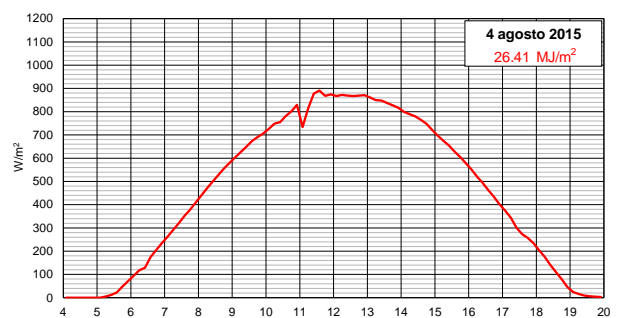
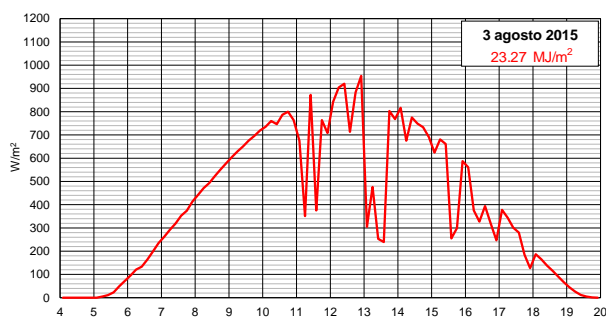
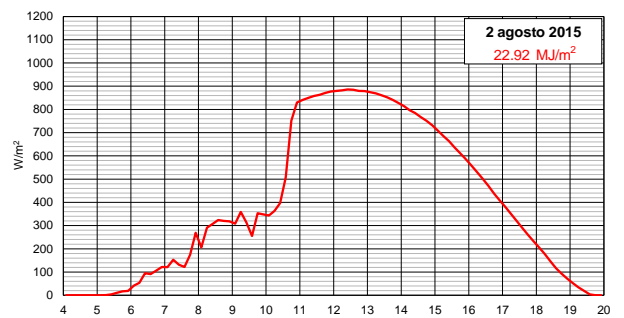
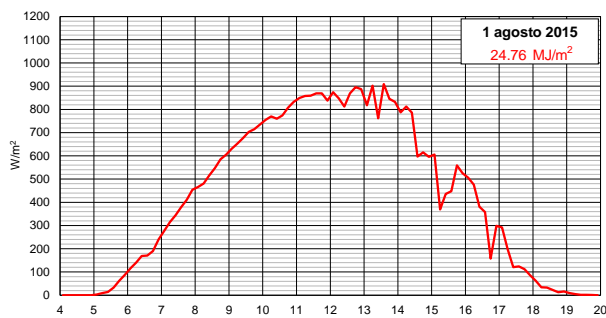
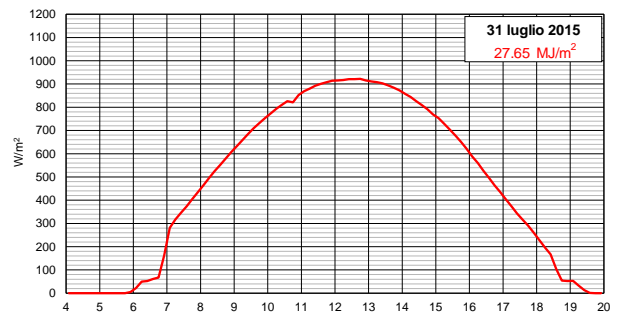
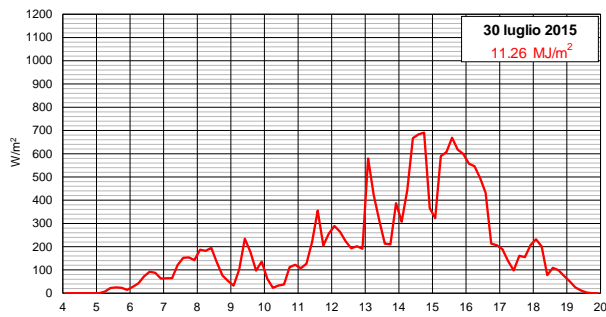
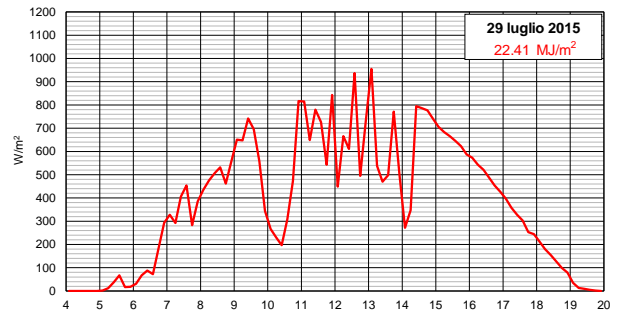
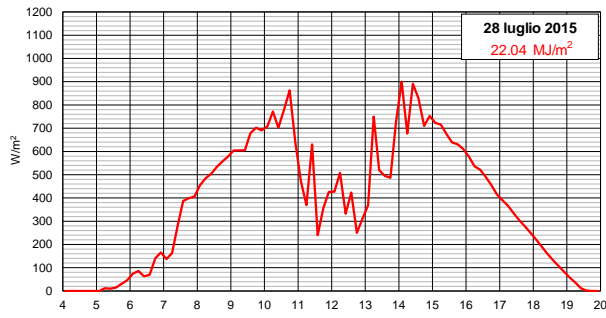
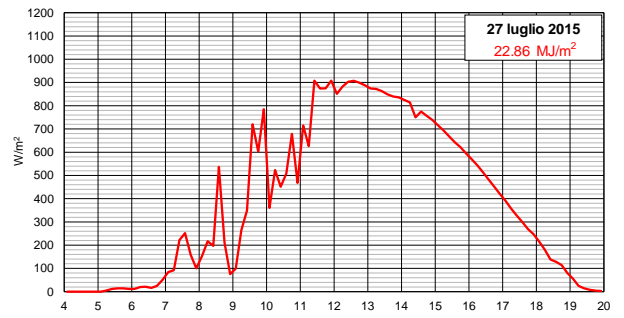
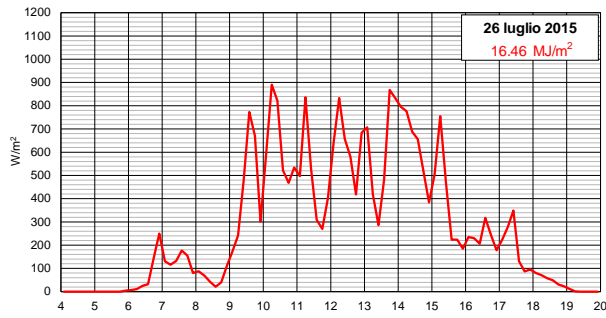
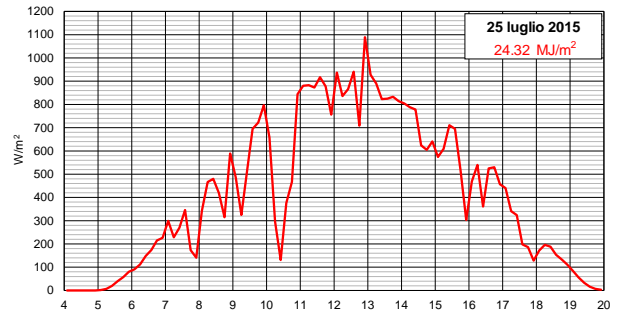
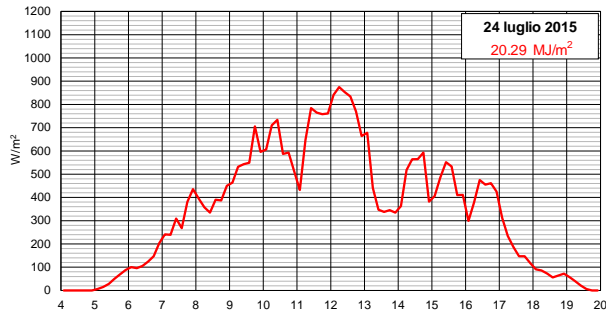


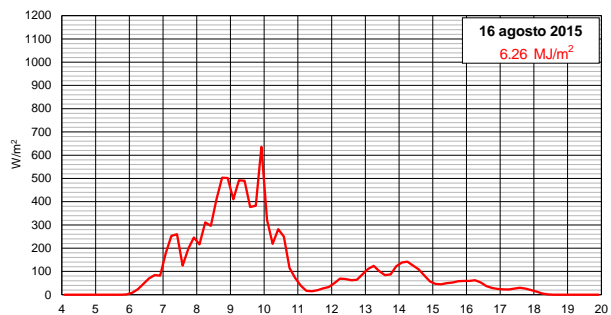
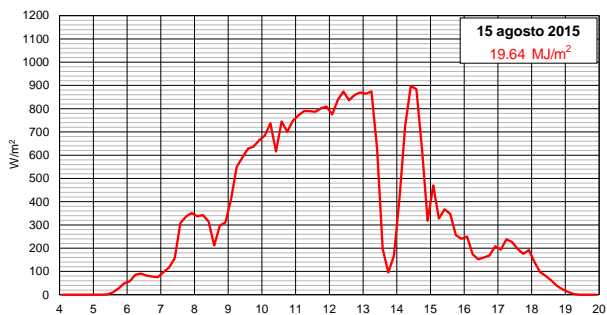
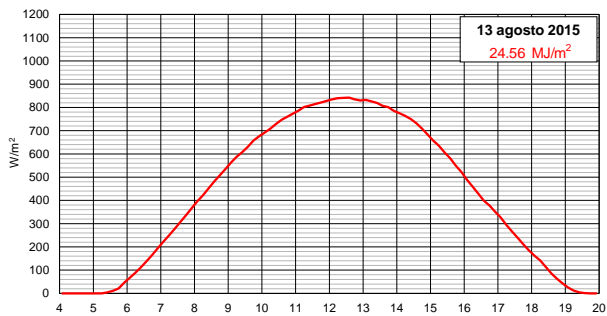
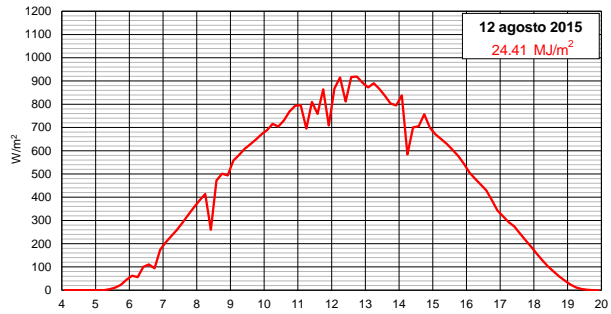
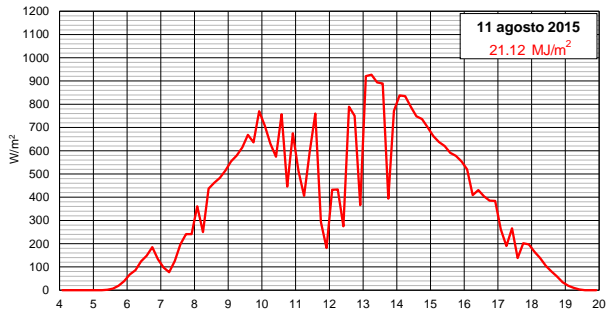
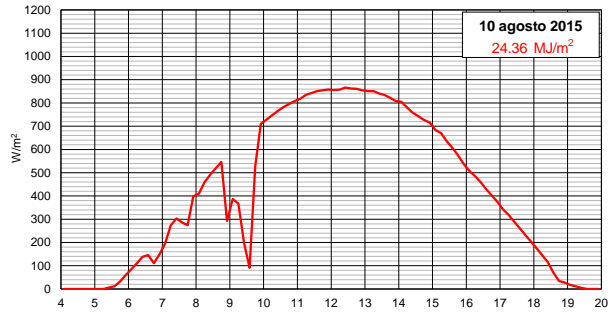
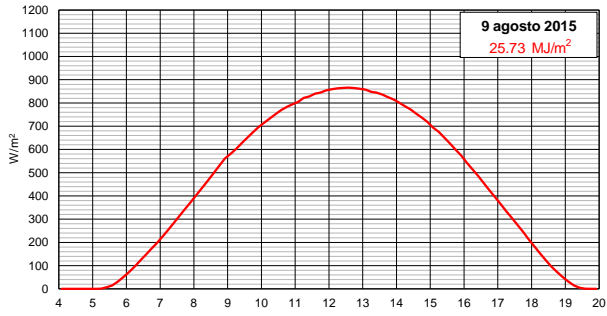
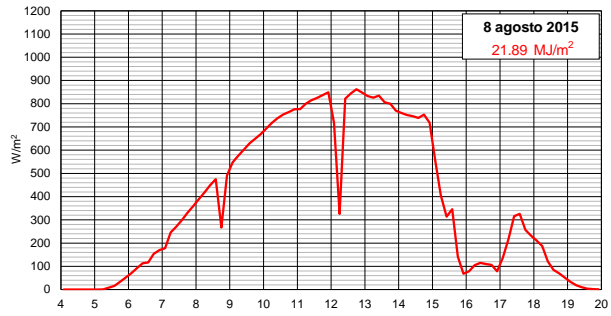
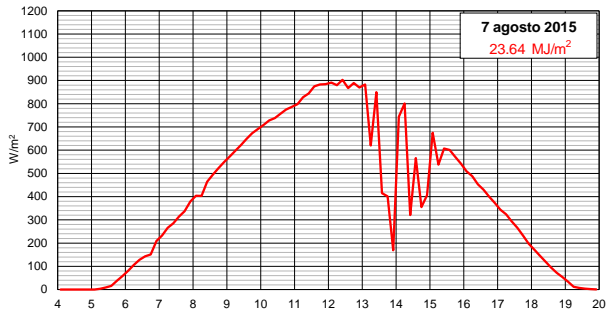
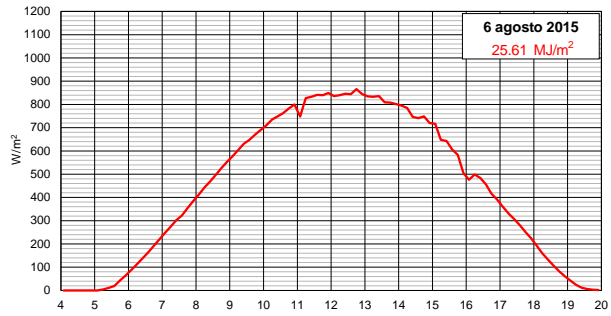
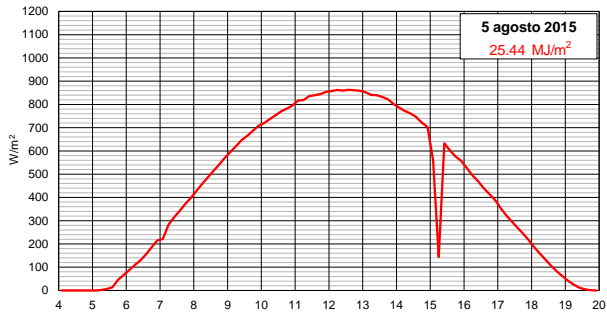


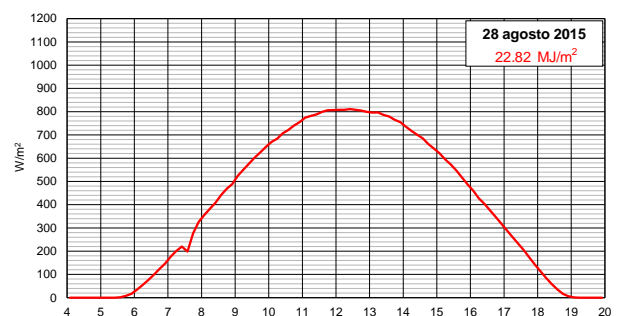
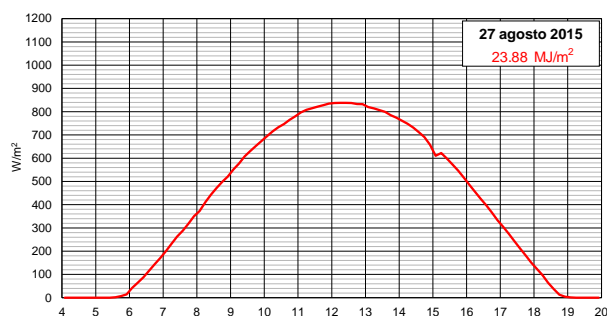
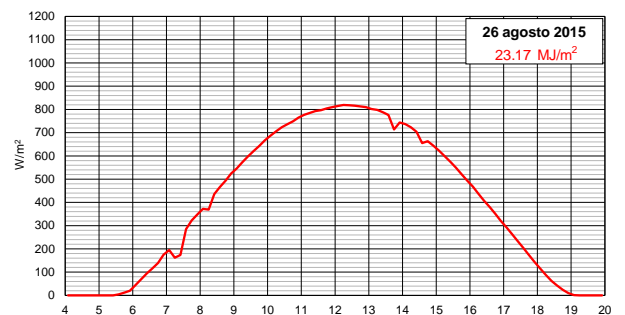
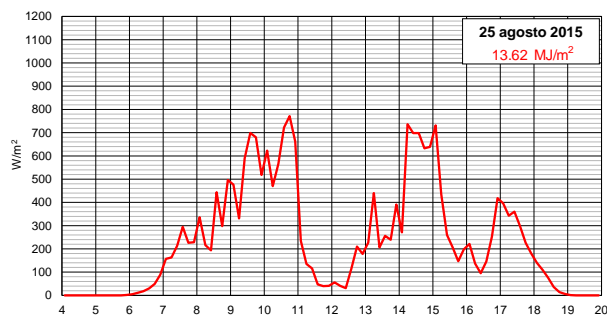
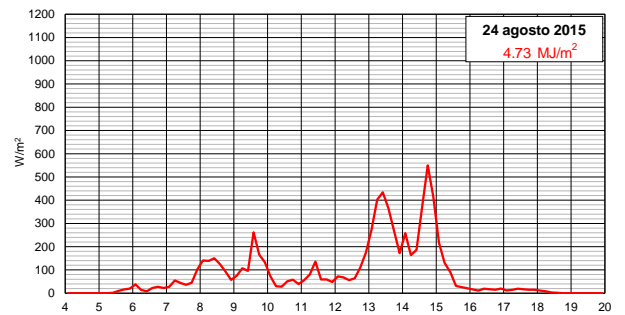
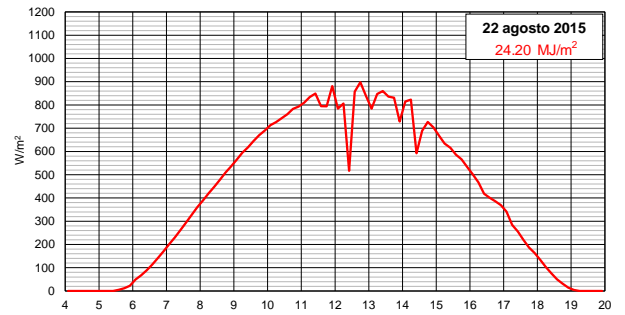
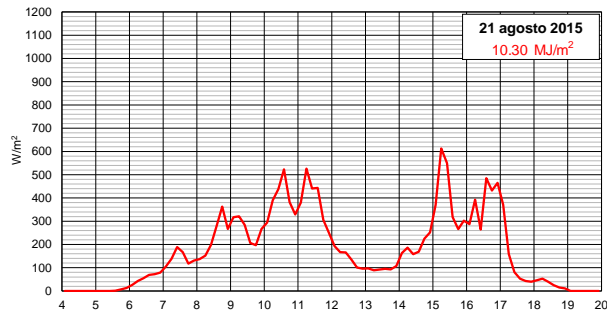
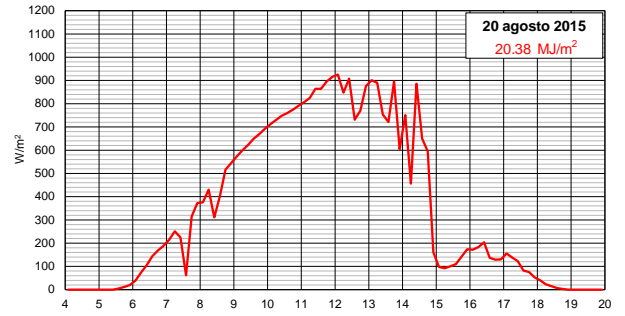
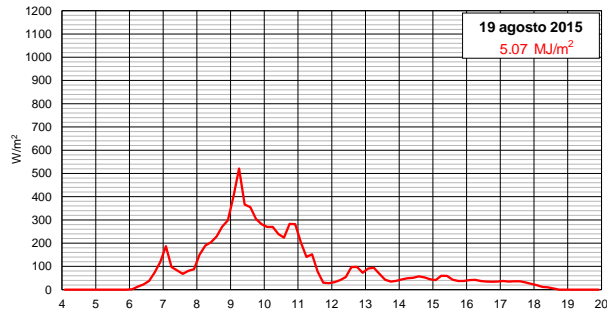
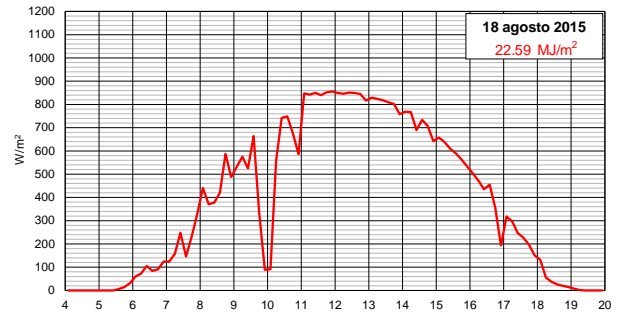
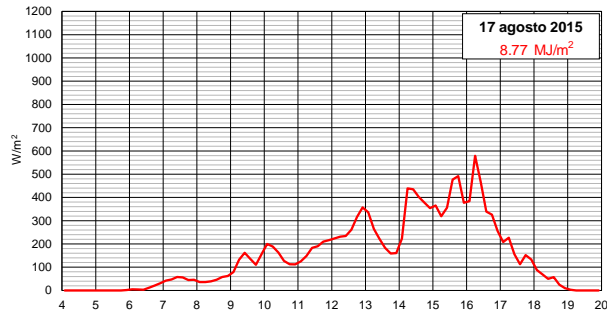


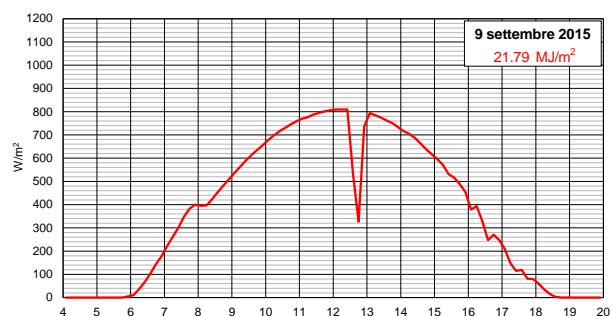
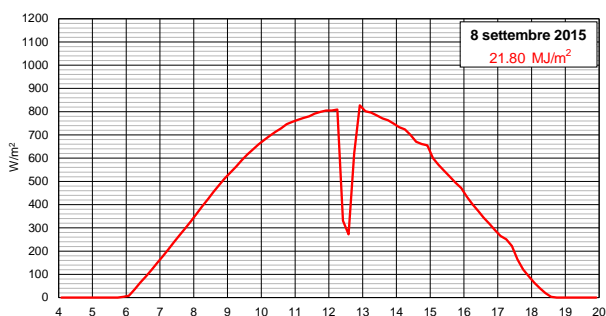
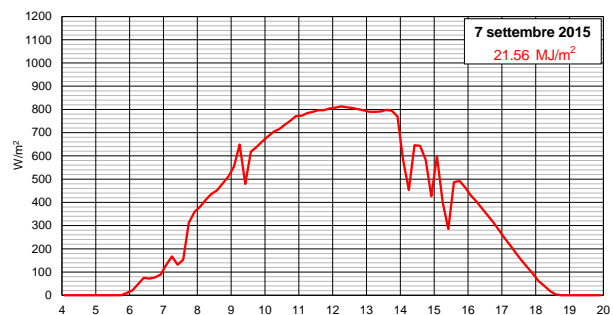
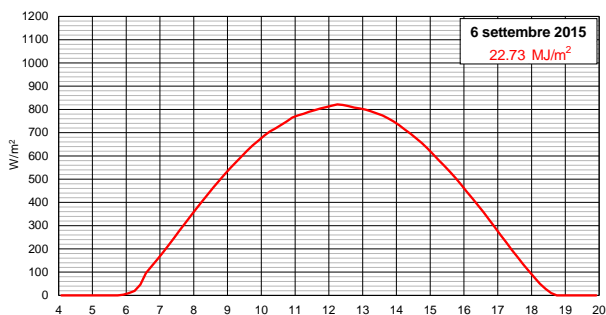
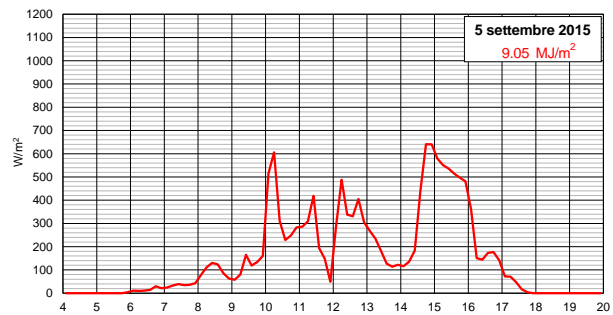
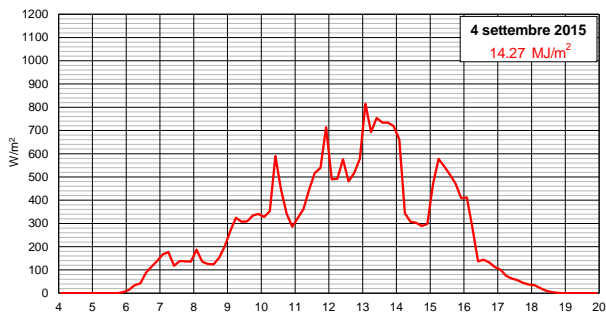
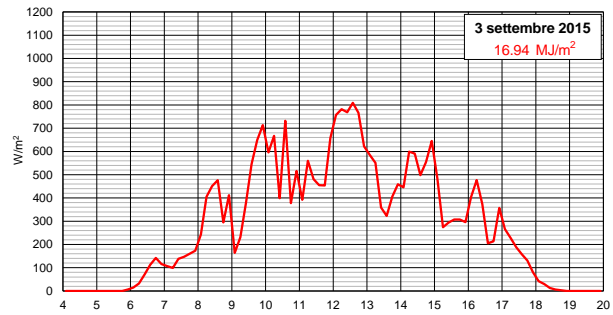
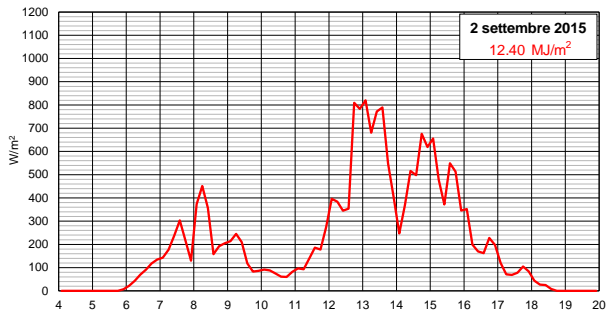
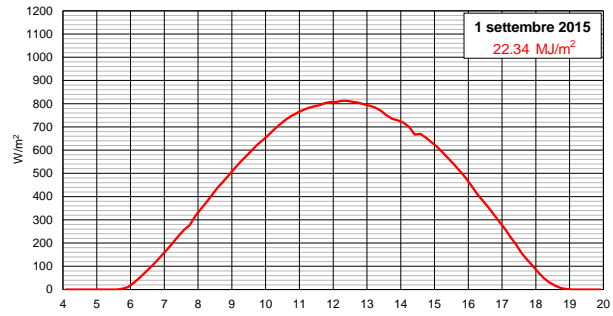
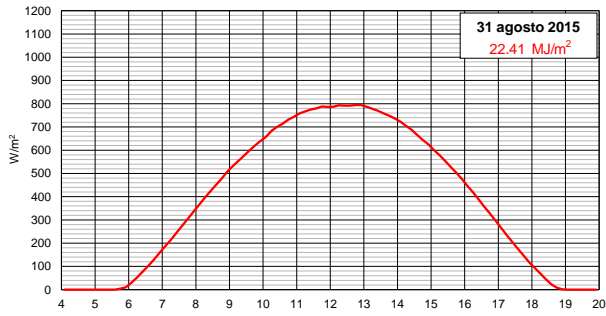
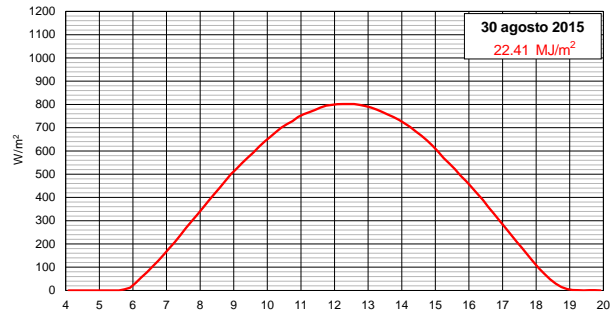
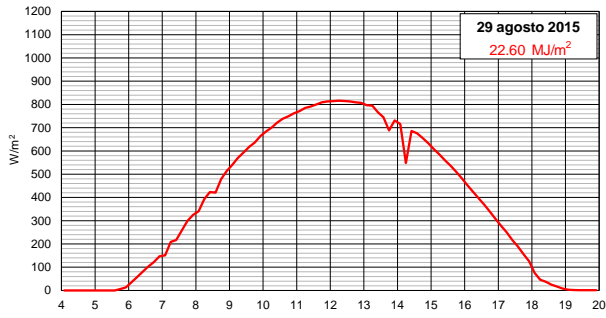


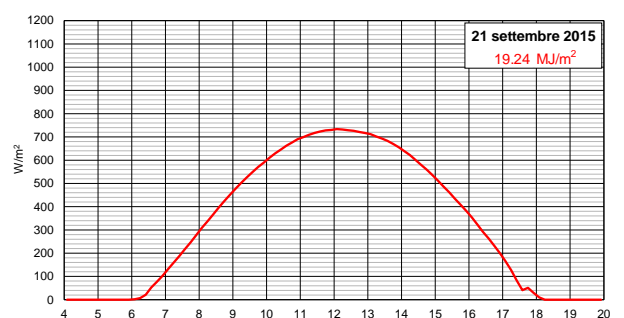
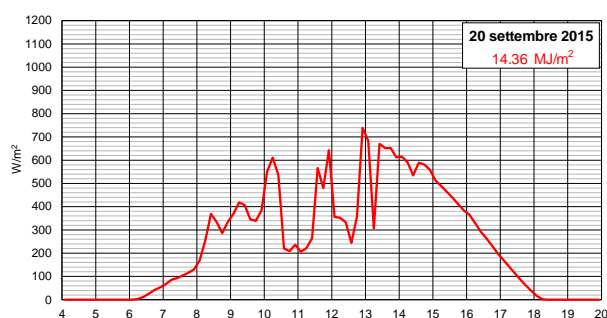
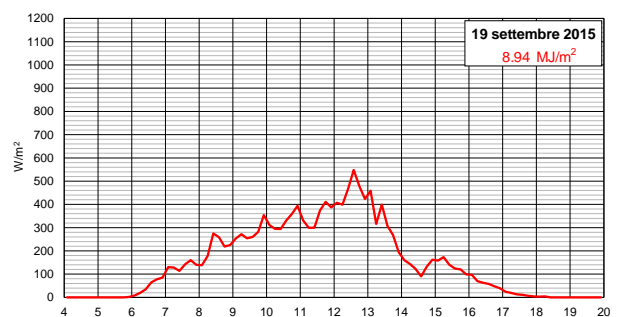
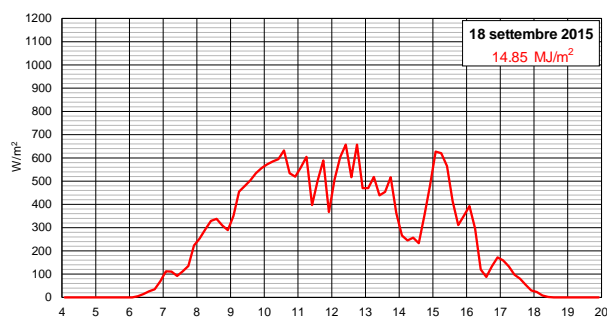
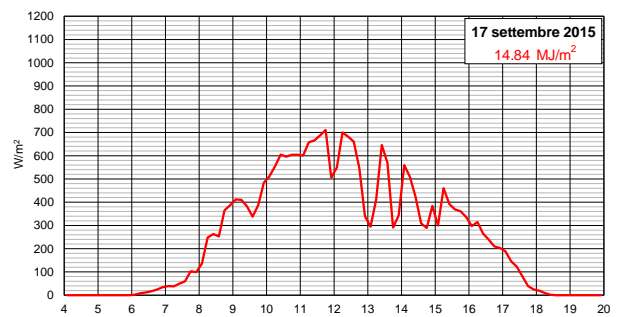
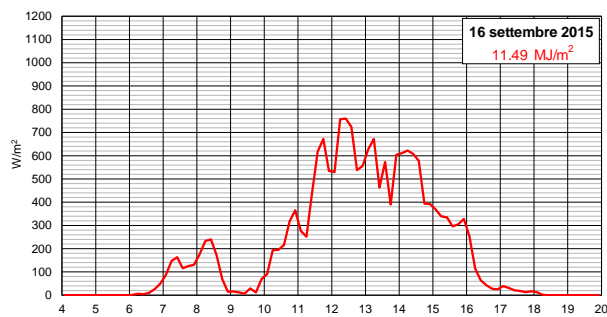
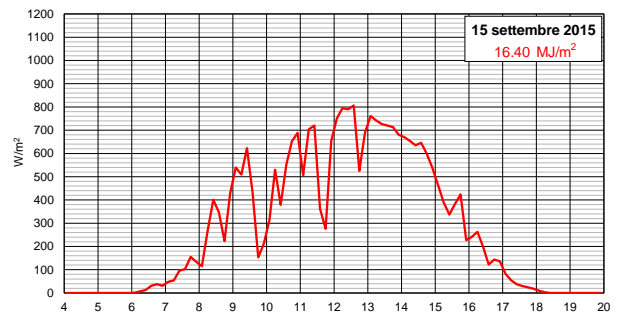
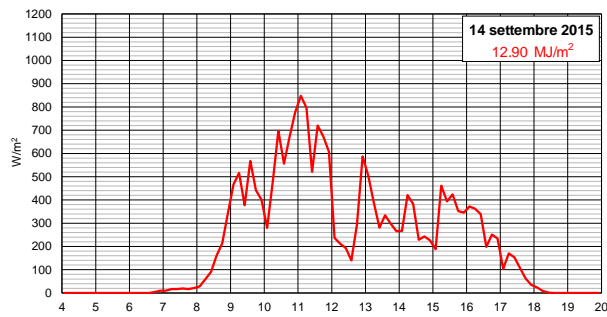
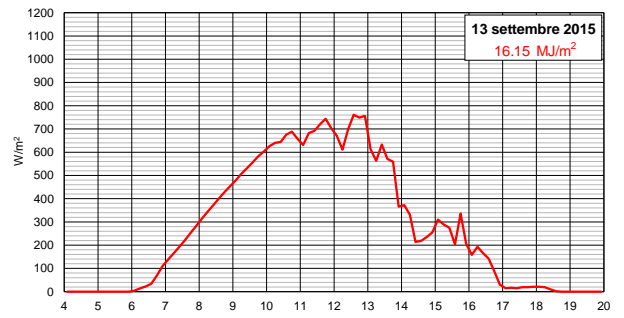
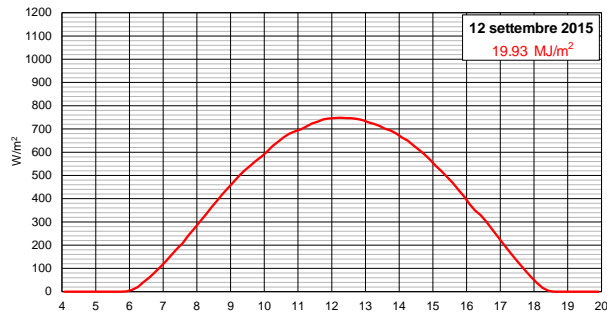
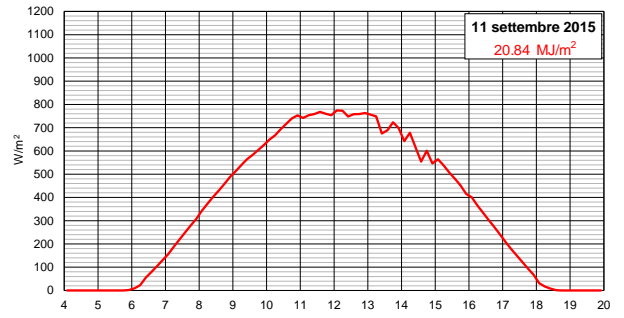
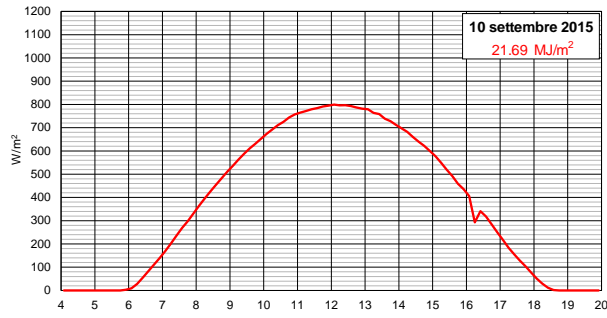


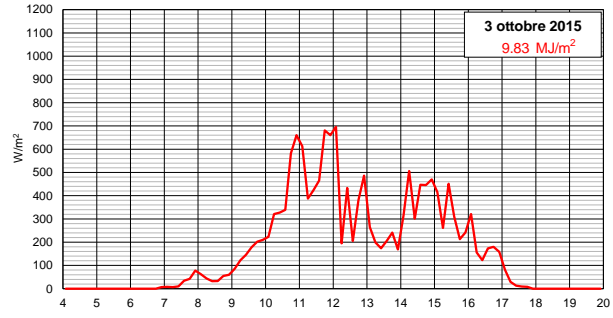
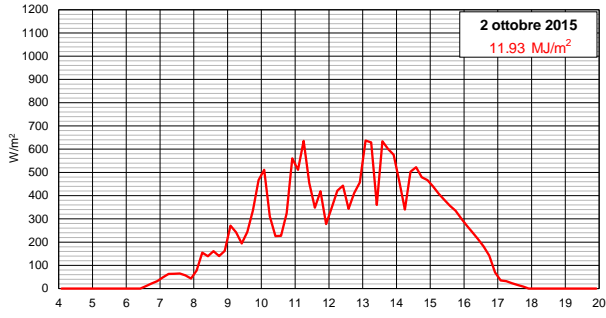
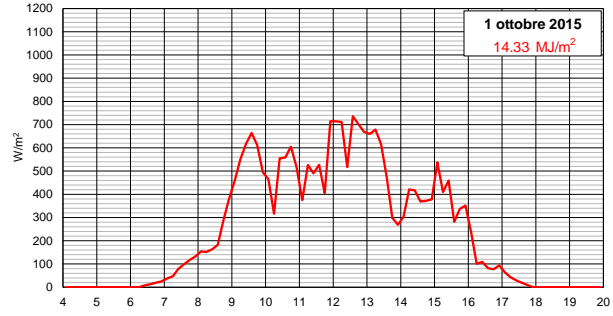
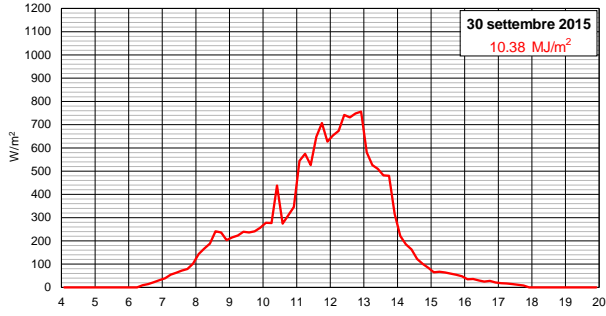
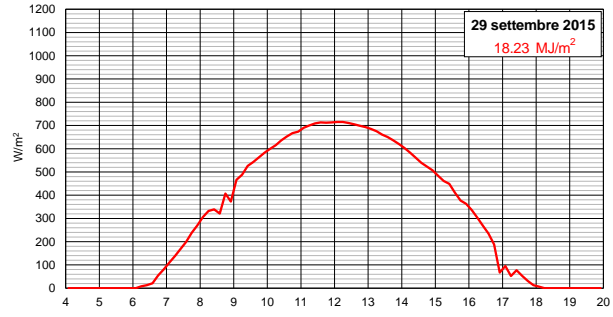
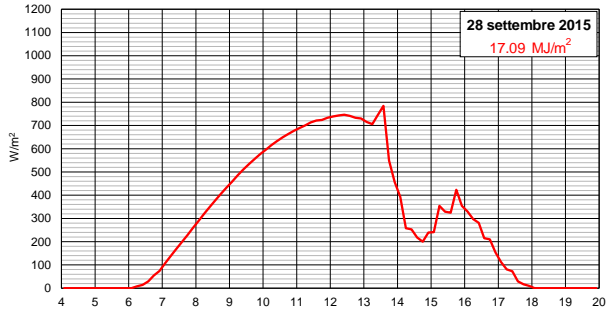
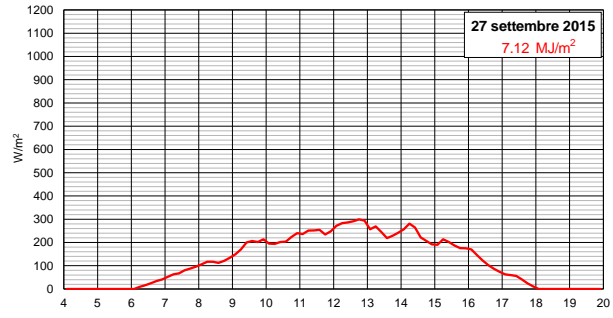
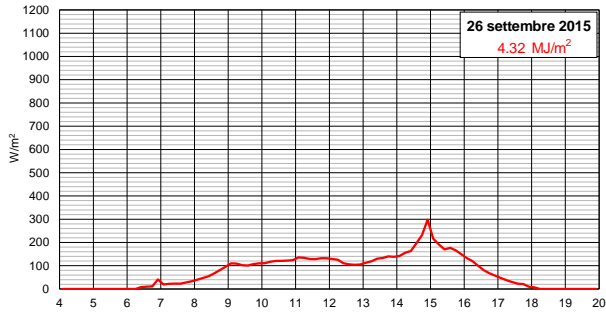
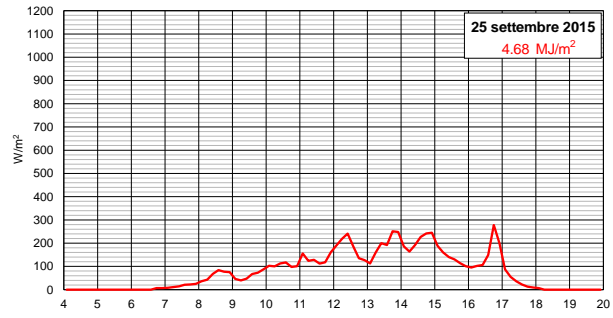
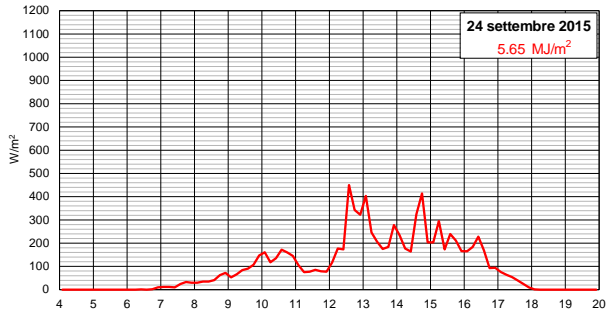
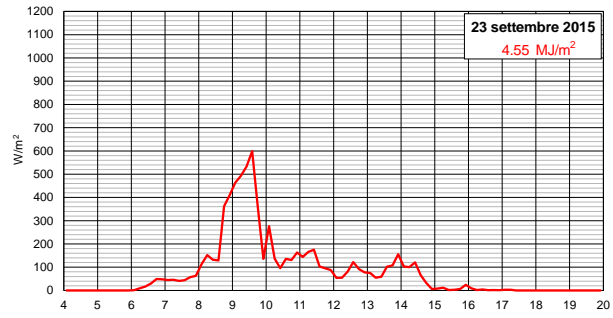
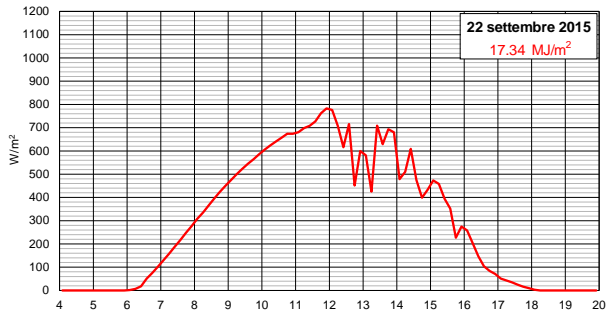


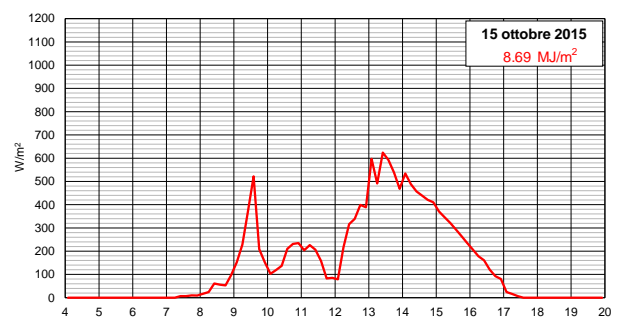
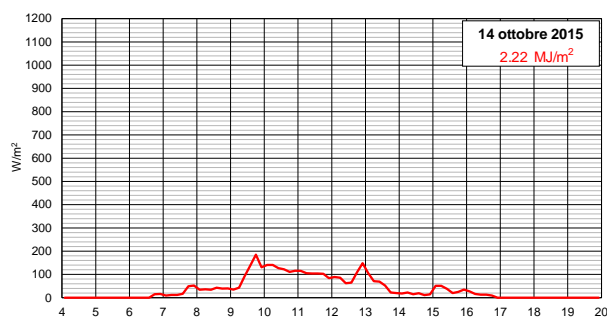
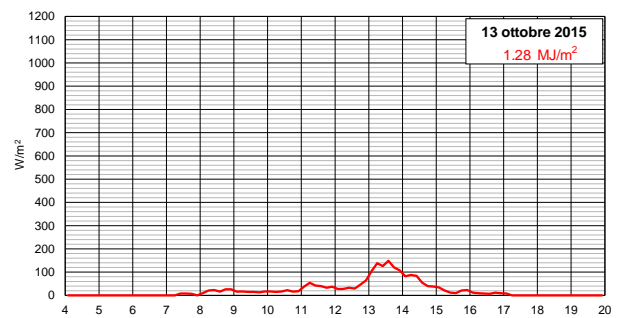
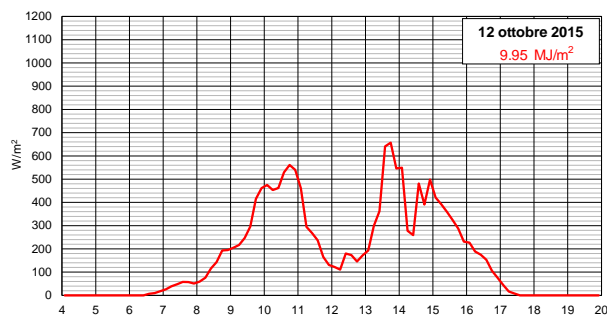
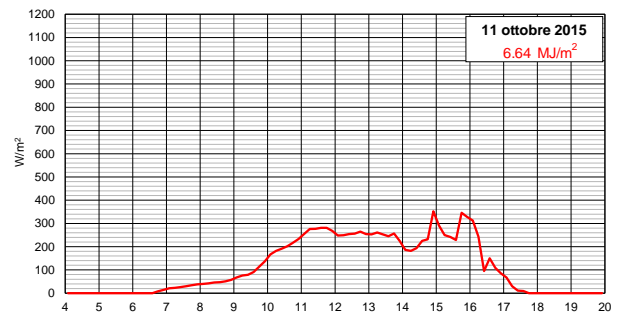
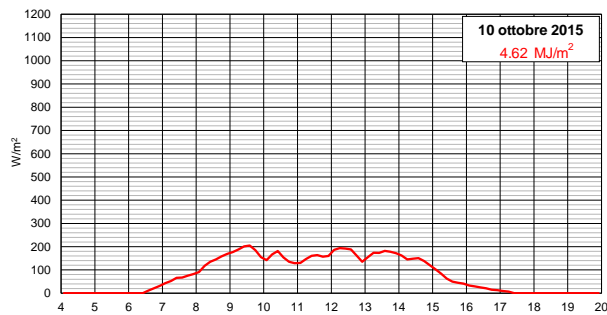
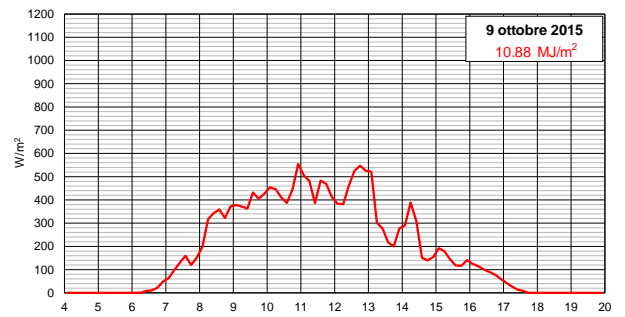
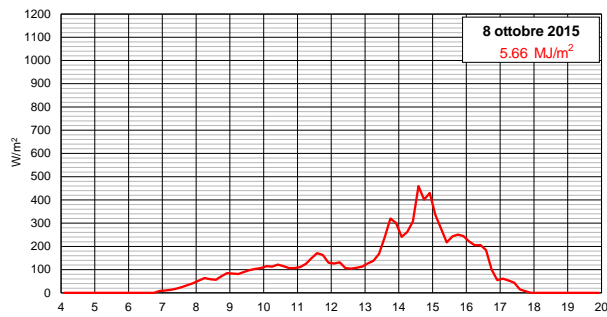
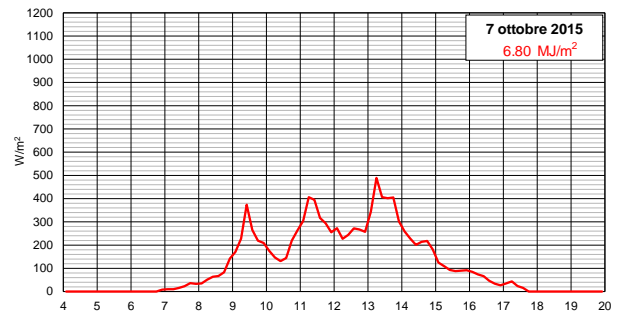
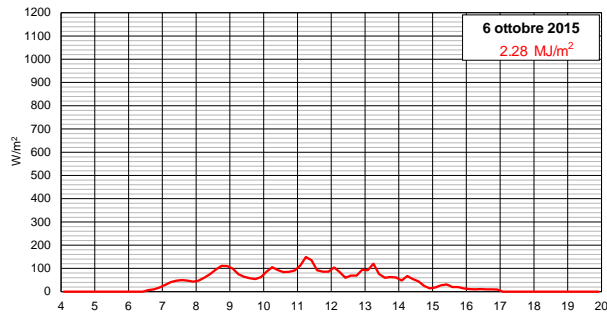
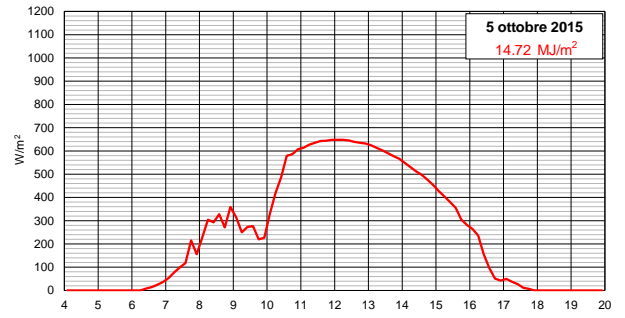
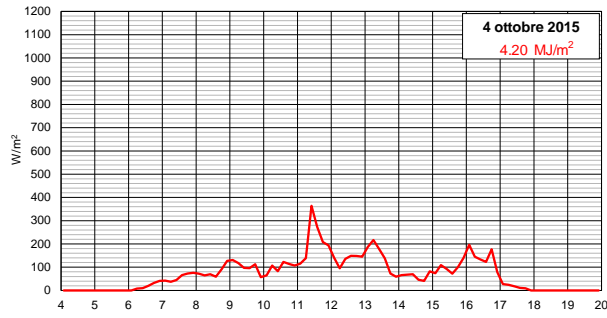


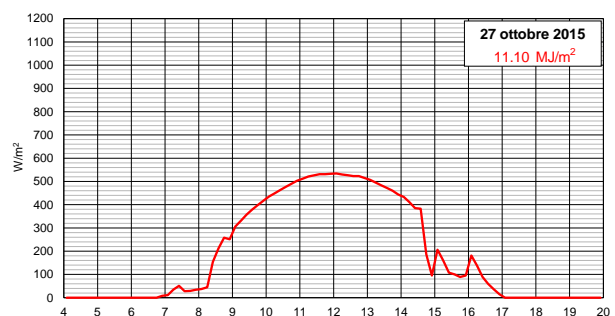
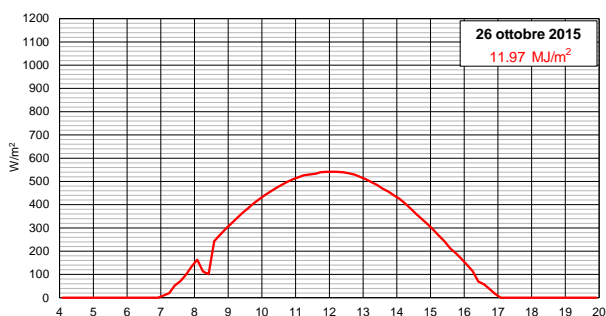
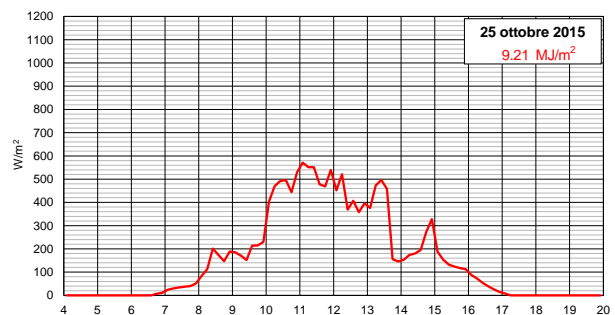
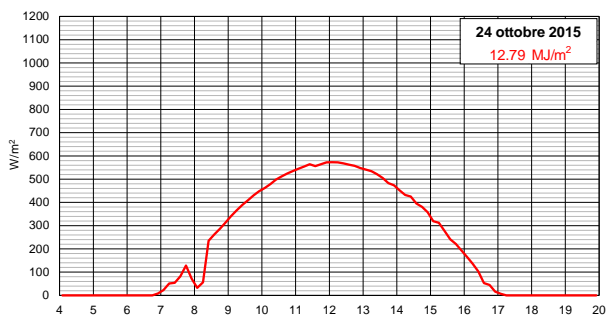
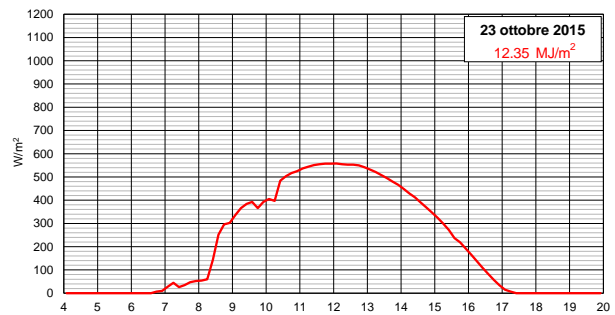
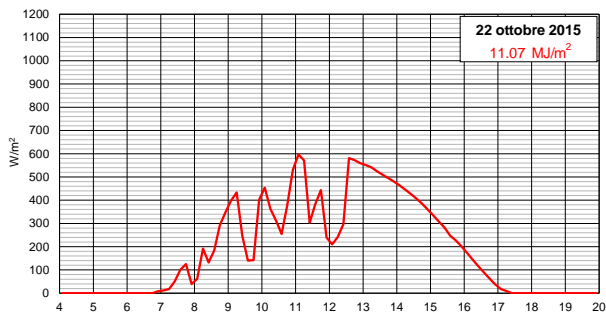
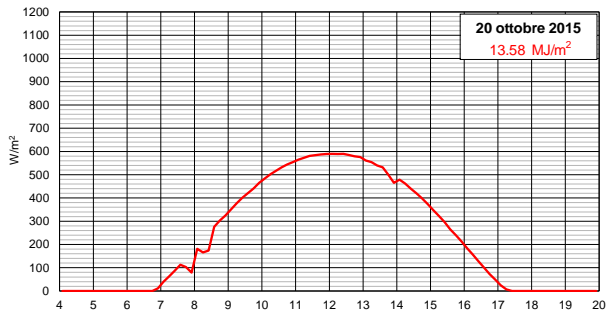
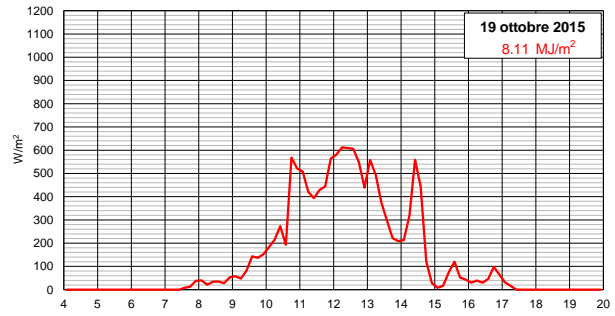
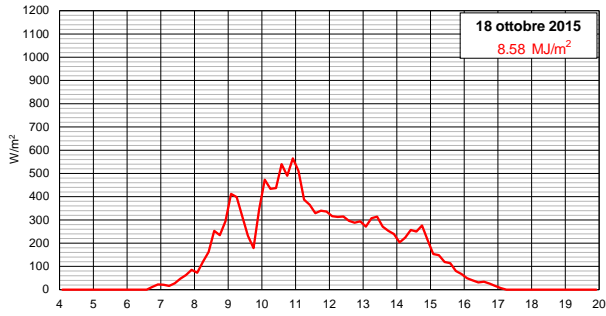
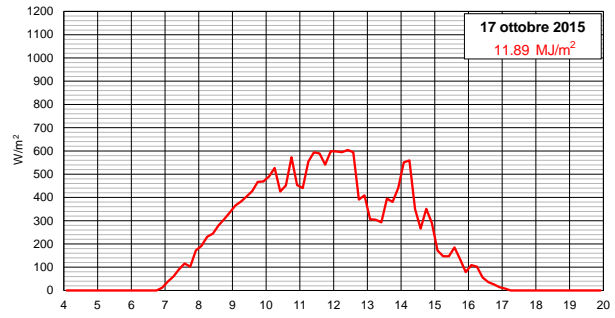
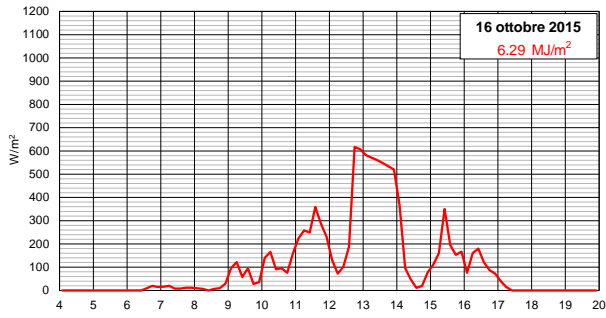


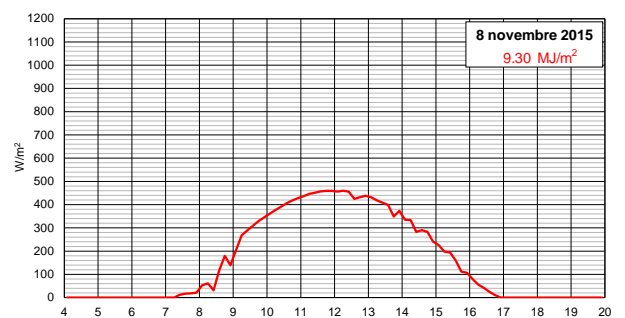
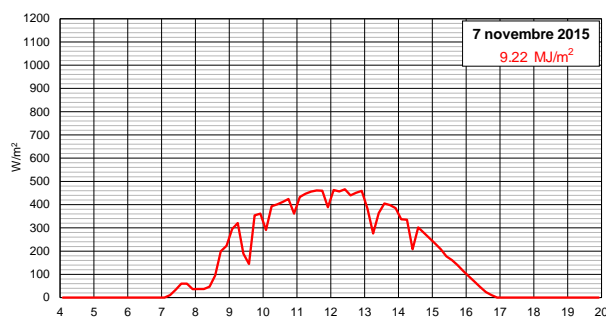
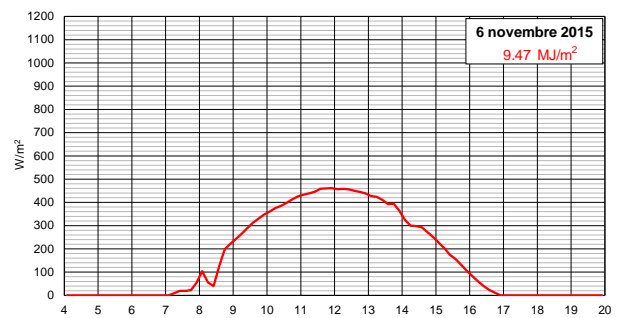
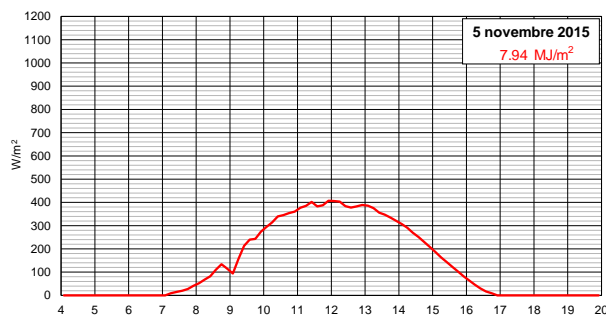
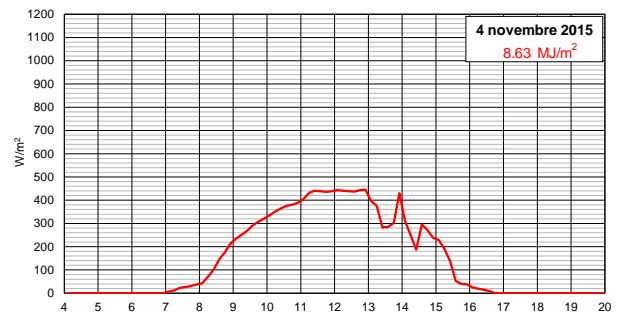
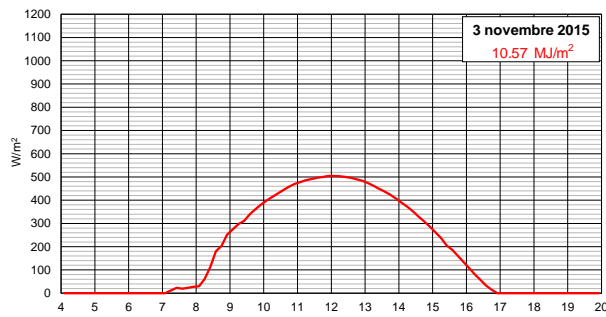
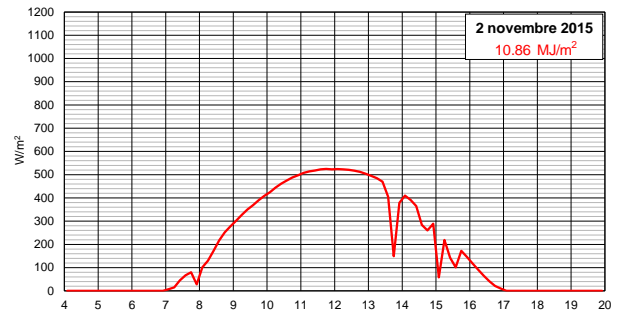
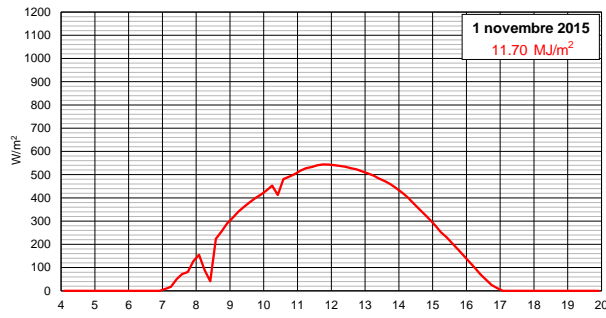
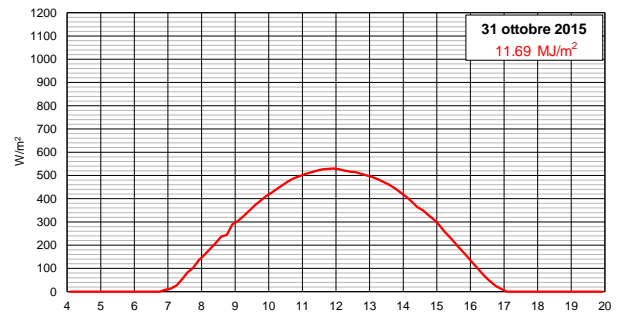
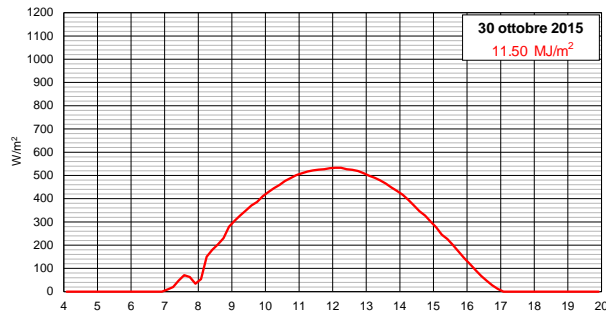
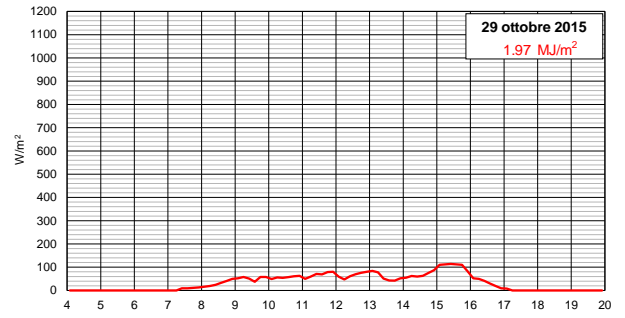
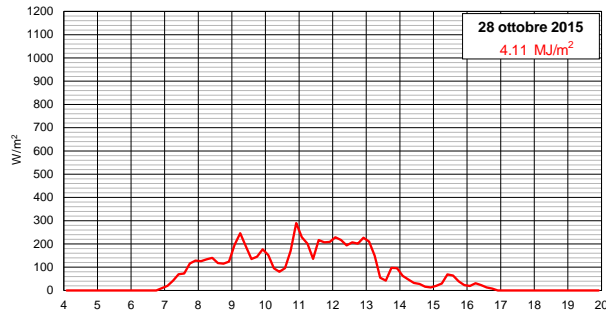


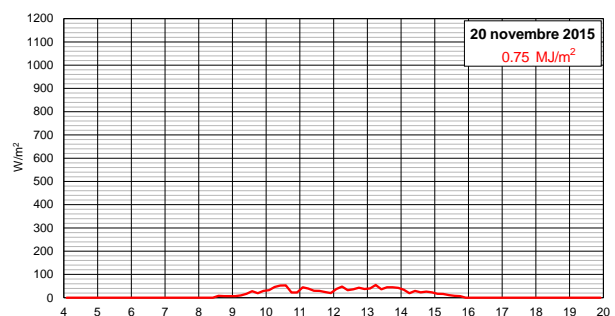
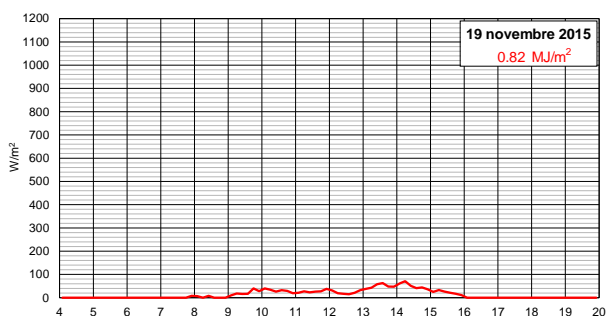
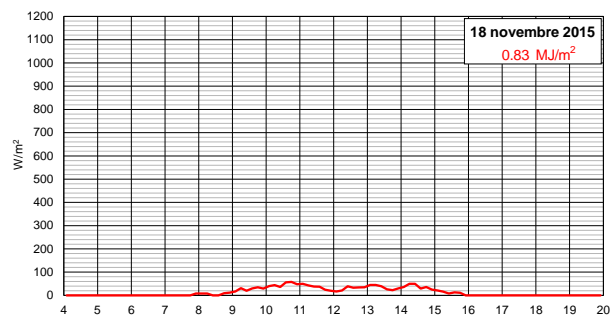
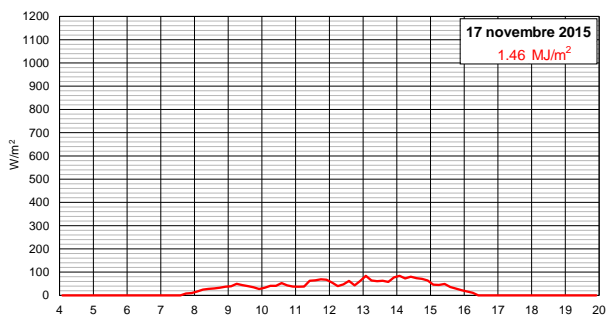
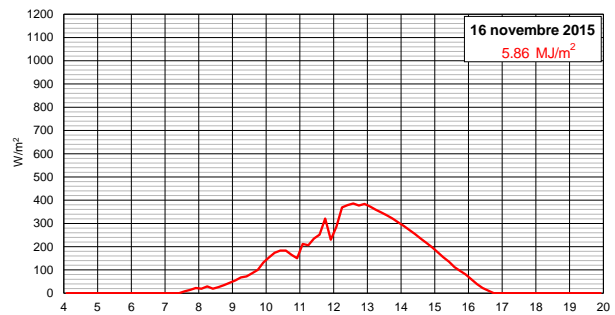
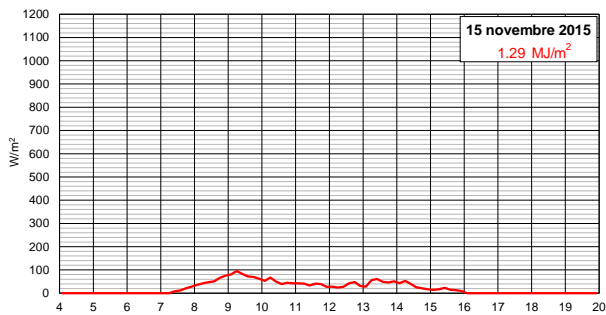
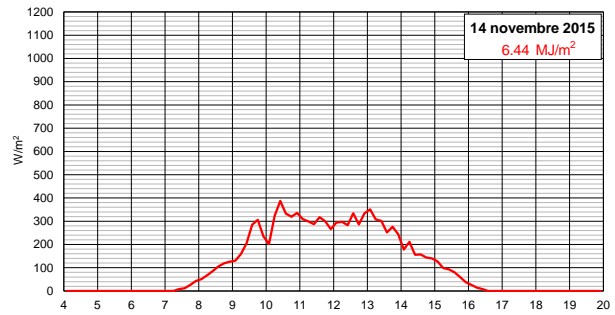
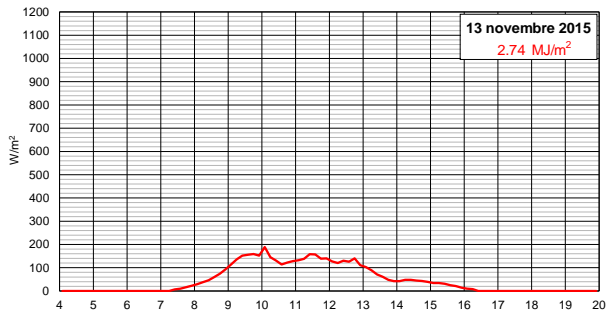
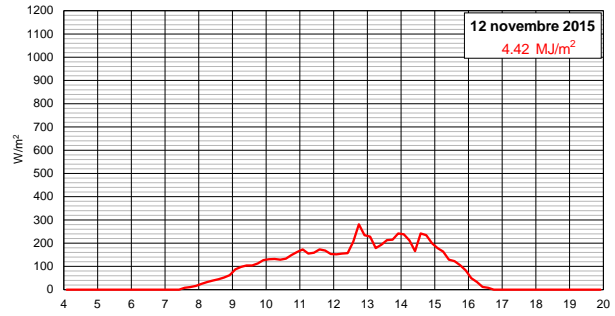
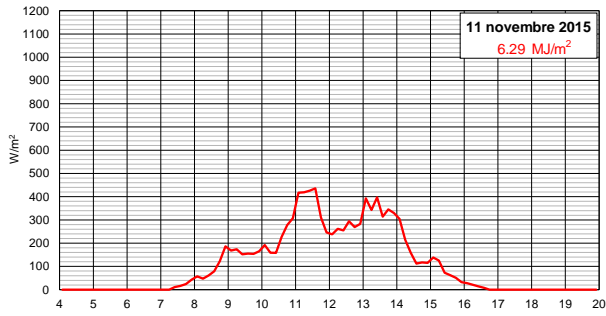
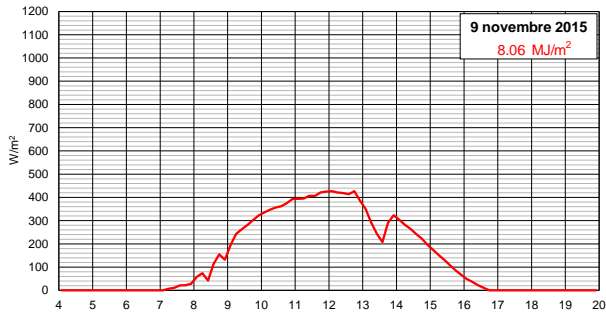


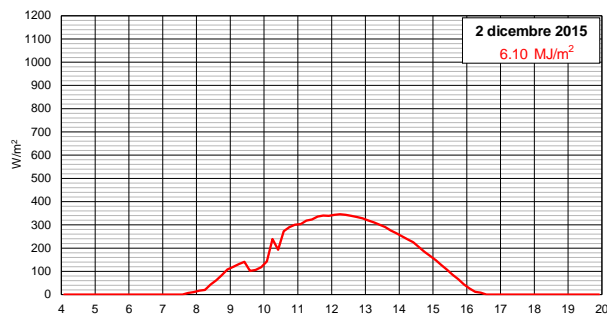
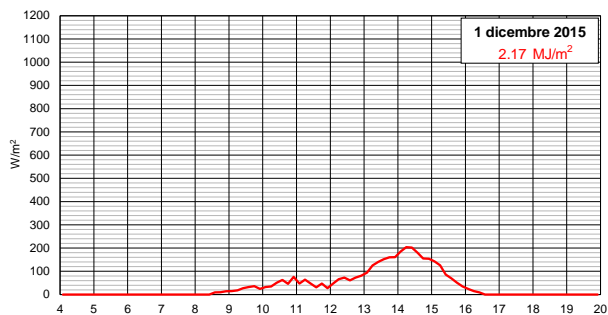
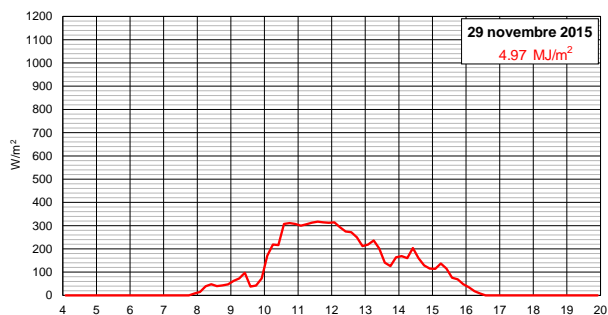
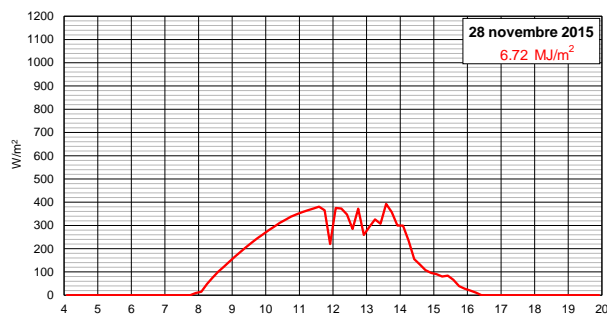
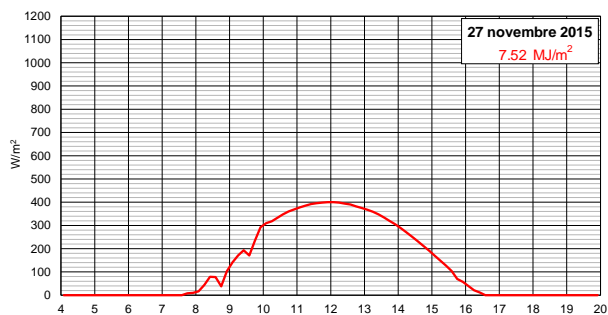
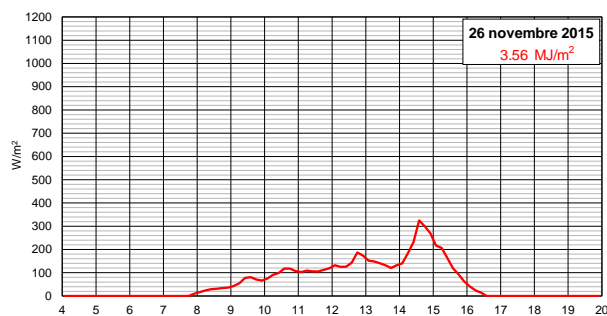
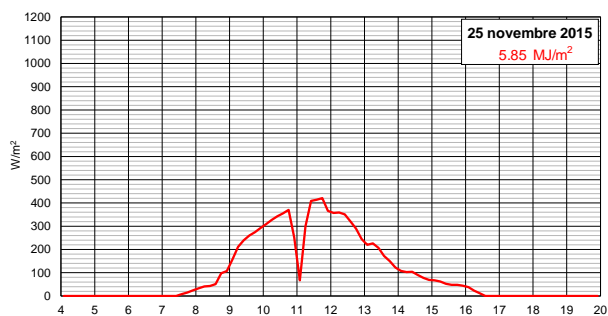
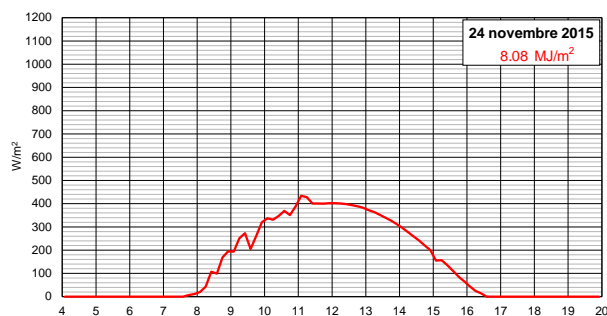
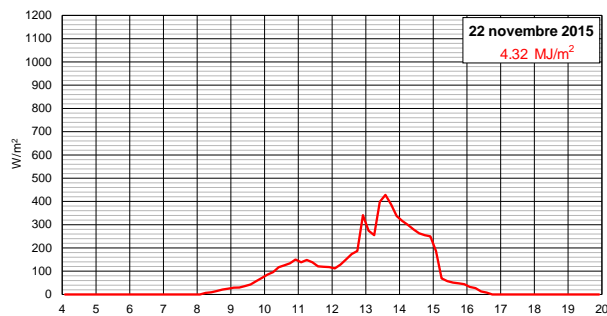
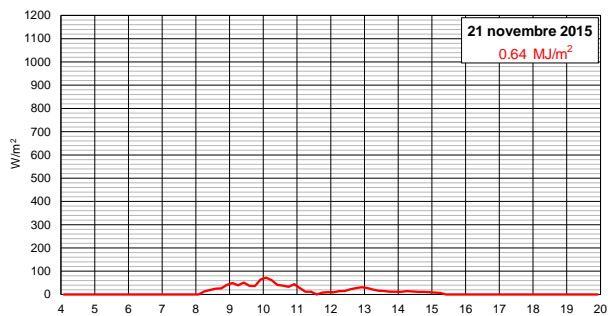


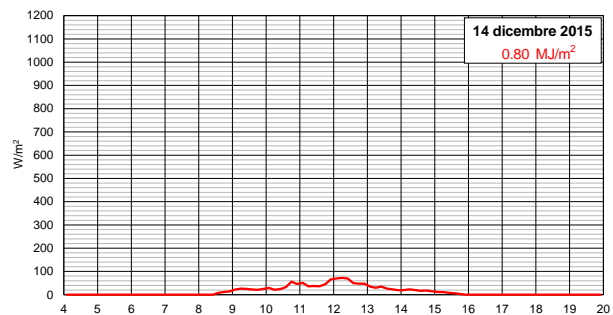
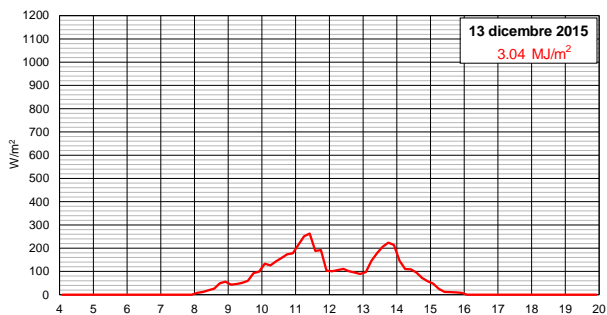
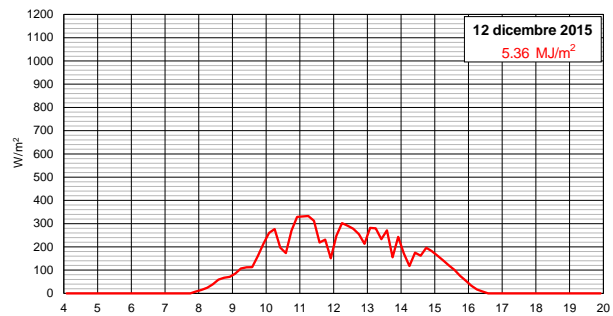
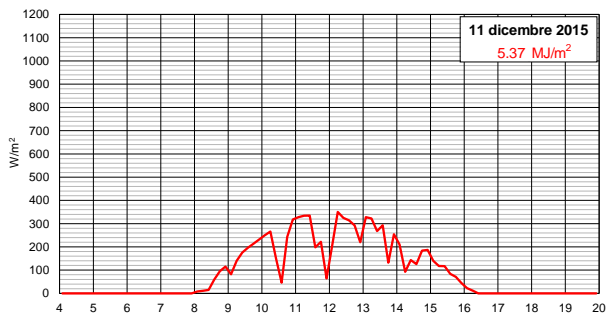
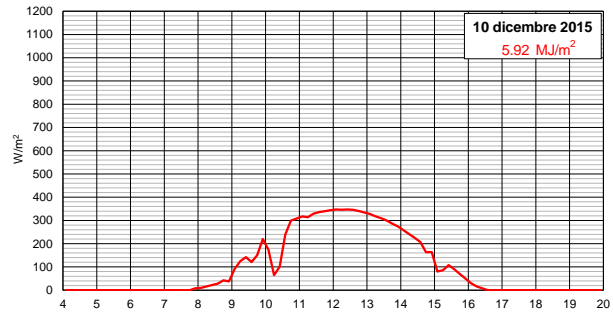
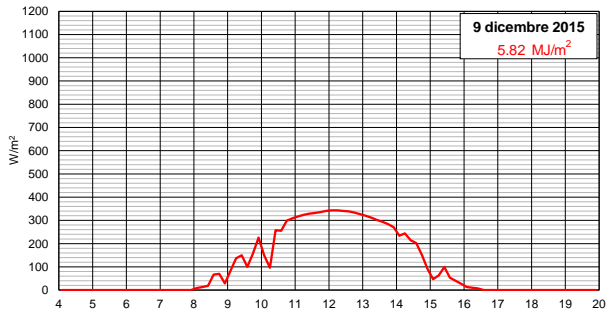
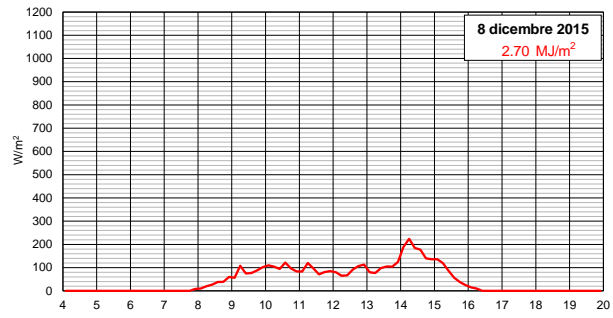
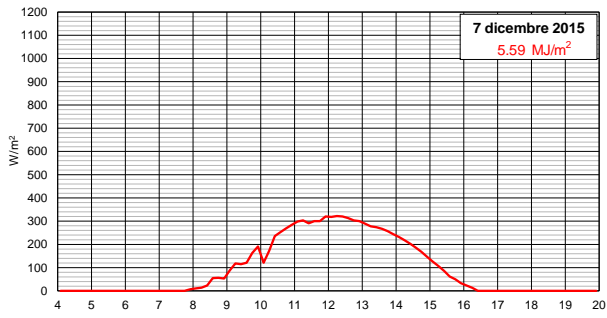
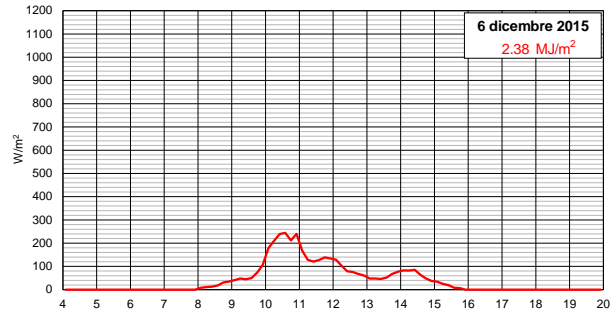
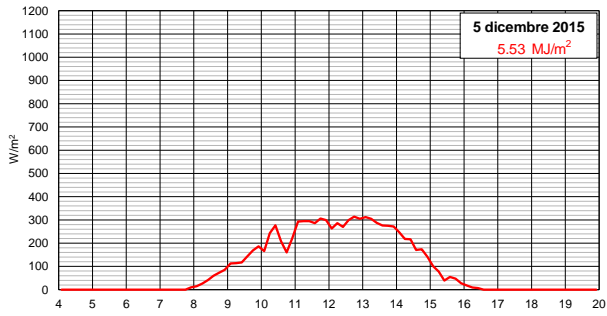
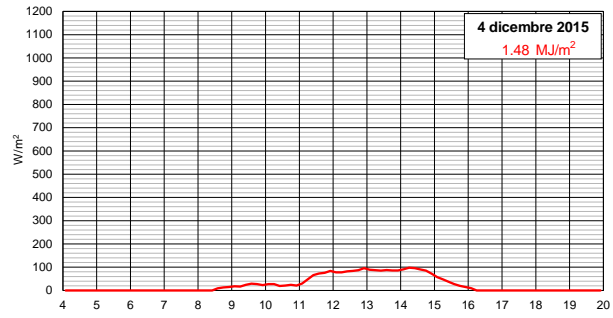
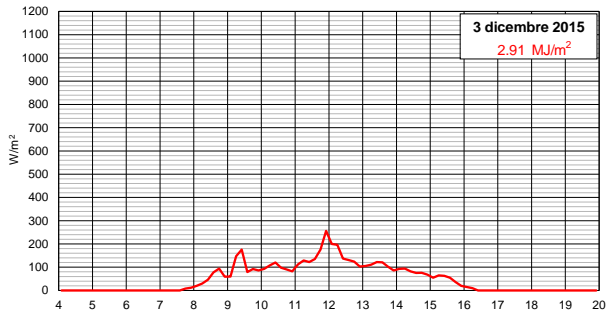


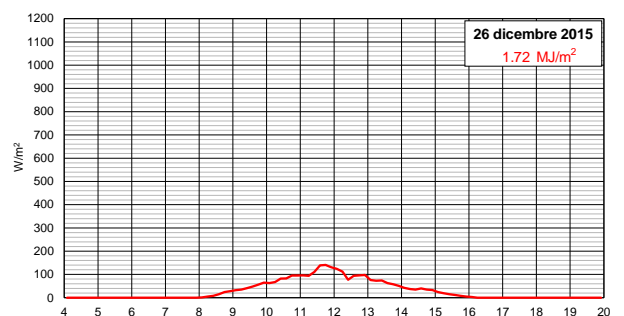
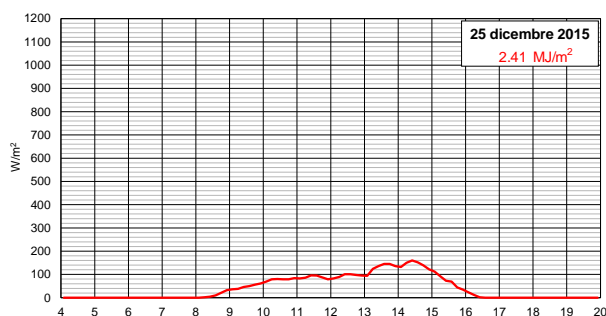
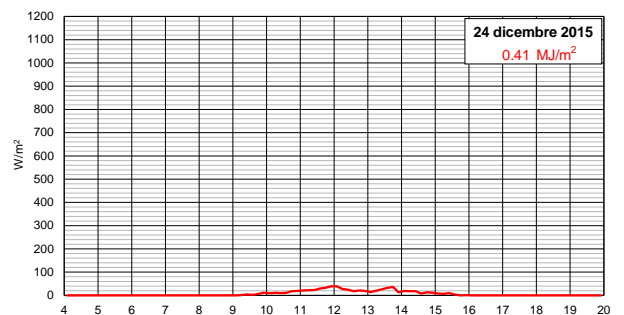
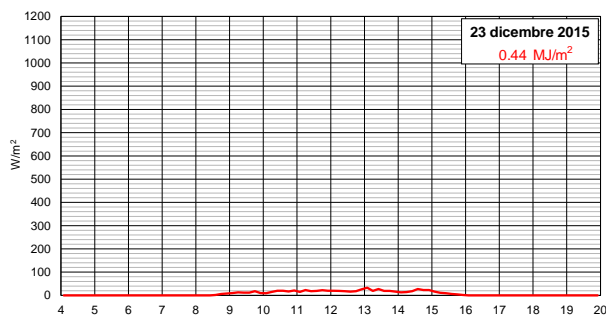
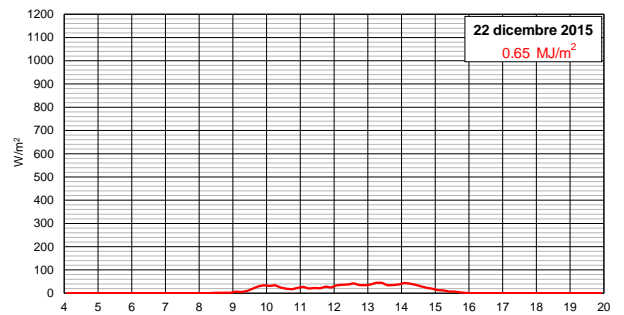
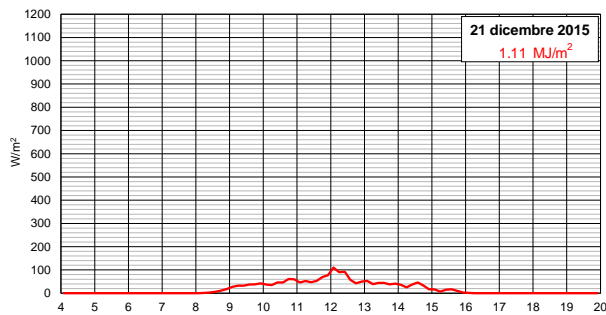
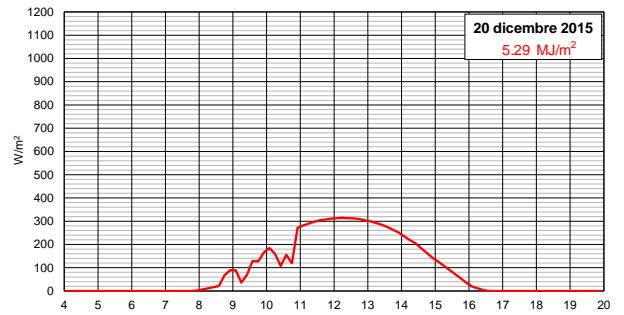
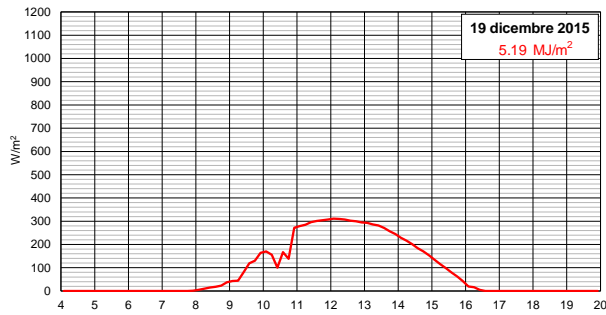
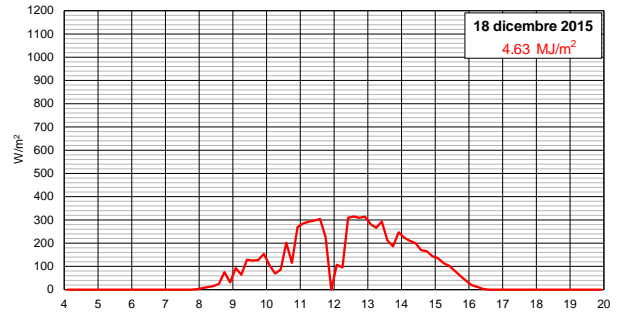
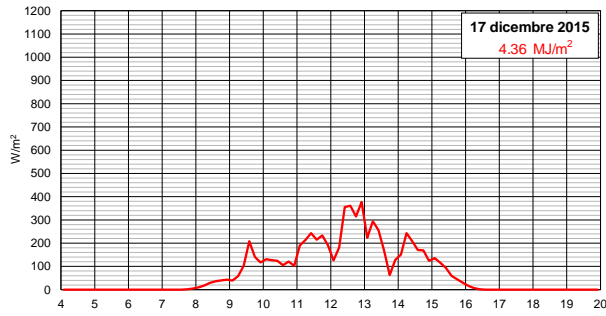
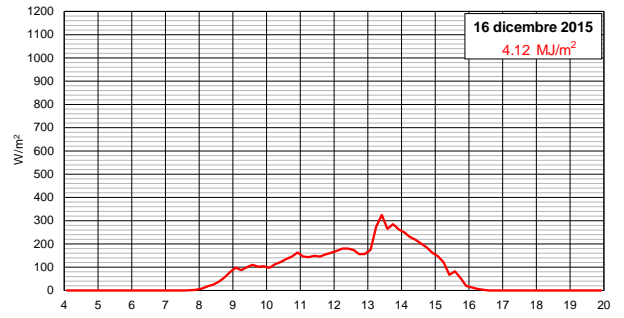
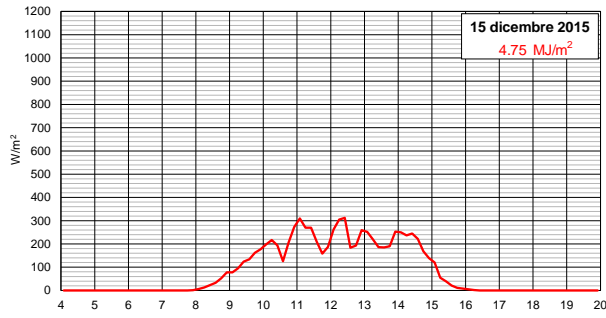


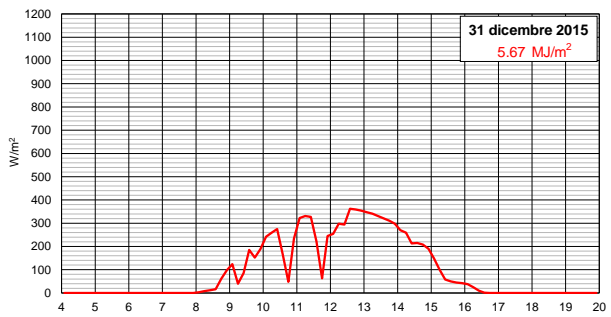
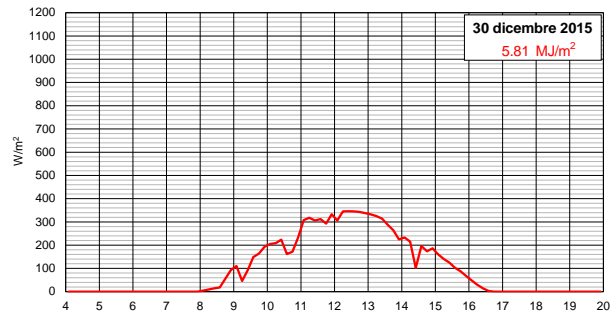
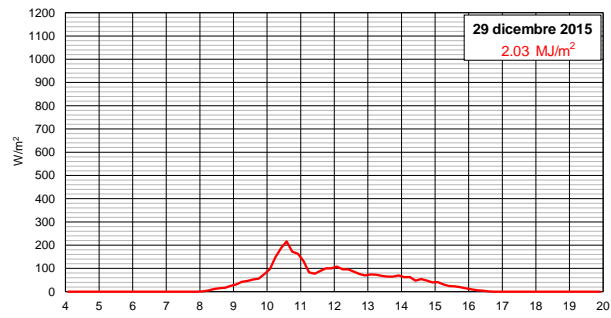
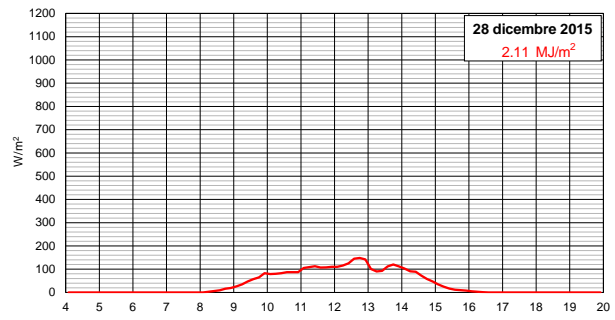
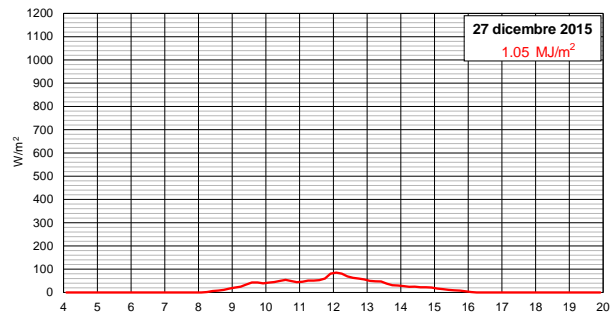












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TRIESTE 2015 Irradiazione solare globale giornaliera /(MJ/m²) **5050.60 MJ/m²**

	GEN	FEB	MAR	APR	MAG	GIU	LUG	AGO	SET	OTT	NOV	DIC
1	5.89	2.38	10.25	21.81	6.03	28.21	27.34	24.76	22.34	14.33	11.70	2.17
2	5.67	8.10	0.82	17.33	10.11	27.19	27.91	22.92	12.40	11.93	10.86	6.10
3	5.96	3.04	15.19	23.64	5.68	27.82	26.09	23.27	16.94	9.83	10.57	2.91
4	6.62	4.77	6.08	4.12	14.05	21.96	27.38	26.43	14.27	4.20	8.63	1.48
5	7.61	1.52	11.21	17.74	22.25	28.40	28.05	25.44	9.05	14.72	7.94	5.53
6	6.34	1.56	16.75	19.40	18.92	29.26	25.33	25.62	22.73	2.28	9.47	2.38
7	1.64	4.34	16.91	23.14	27.57	29.41	27.20	23.64	21.56	6.80	9.22	5.59
8	1.60	9.76	17.29	22.83	26.44	29.21	25.19	21.89	21.80	5.66	9.30	2.70
9	0.50	9.61	16.59	22.15	20.58	27.67	26.42	25.73	21.79	10.88	8.06	5.82
10	2.95	9.68	16.16	22.47	27.64	28.28	30.16	24.36	21.69	4.62	4.88	5.92
11	0.41	11.42	8.49	20.99	26.18	28.05	29.51	21.12	20.84	6.64	6.29	5.37
12	7.24	10.71	9.34	23.67	23.99	26.34	27.97	24.41	19.93	9.95	4.42	5.36
13	8.01	2.41	17.24	22.94	23.84	24.37	17.90	24.56	16.15	1.28	2.74	3.04
14	2.56	1.24	16.60	20.46	18.44	17.69	27.68	22.45	12.90	2.22	6.44	0.80
15	2.27	6.89	14.17	22.96	4.79	24.76	27.36	19.65	16.40	8.69	1.29	4.75
16	1.51	11.85	1.56	21.31	23.68	19.01	25.63	6.26	11.49	6.29	5.86	4.12
17	1.06	12.76	7.47	5.38	26.62	23.67	26.85	8.77	14.84	11.89	1.46	4.36
18	8.41	13.69	17.97	3.78	26.97	26.22	26.83	22.59	14.85	8.58	0.83	4.63
19	7.59	13.50	17.62	25.92	25.59	13.93	26.96	5.07	8.94	8.11	0.82	5.19
20	3.94	12.13	11.97	25.02	14.01	15.47	26.14	20.38	14.36	13.58	0.75	5.29
21	2.75	5.11	7.56	24.82	21.28	25.41	26.91	10.30	19.24	11.13	0.64	1.11
22	2.30	2.40	6.77	24.87	4.94	22.43	27.43	24.20	17.34	11.07	4.32	0.65
23	3.68	3.57	16.91	18.48	6.49	4.59	21.89	21.57	4.55	12.35	5.15	0.44
24	3.01	4.24	13.45	17.68	27.28	29.96	20.29	4.73	5.65	12.79	8.08	0.41
25	3.42	8.91	2.04	22.30	23.02	27.76	24.32	13.62	4.68	9.21	5.85	2.41
26	8.59	13.09	4.57	18.77	21.85	29.79	16.46	23.17	4.32	11.97	3.56	1.72
27	5.71	14.38	2.88	8.30	18.76	22.52	22.86	23.88	7.12	11.10	7.52	1.05
28	9.46	14.91	18.59	5.69	29.20	30.89	22.04	22.82	17.09	4.11	6.72	2.11
29	1.43		15.85	26.09	28.60	22.97	22.41	22.60	18.23	1.97	4.97	2.03
30	1.09		15.02	9.87	27.77	27.95	11.26	22.41	10.38	11.50	5.66	5.81
31	8.70		11.30		18.06		27.65	22.41		11.69		5.67
	137.91	217.92	364.61	563.91	620.58	741.16	777.38	631.03	443.87	271.36	174.00	106.89