TECHNICAL ABSTRACT

Analysis of Solar Radiation at Lae, Papua New Guinea*

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This report gives an analysis of solar radiation data measured by means of a pyranometer at Lae (7°S, 147°E) during the three years 1975-1977.

Table 2 shows the mean daily global solar radiation throughout the year. Values above 20 MJ/m^2 per day occur from September to February (the relatively dry season), and values lower than 20 MJ/m^2 per day occur from March to August (the relatively wet season).

The mean global solar radiation amounts for each hour of the day (apparent solar time) throughout the year are given in Table 2. They are usually less after midday than before midday, indicating an increase in cloudiness in the afternoon.

The statistical distributions of hourly global solar radiation amounts throughout the day in each period of the year are given in Tables 3 to 10. For the most part the 10th and 30th percentiles are more widely spaced than the 50th, 70th and 90th percentiles, indicating that the distributions of radiation are spread out in the low radiation classes.

Table 1
Mean daily global solar radiation at Lae

	Period	Solar Radiation (MJ/m^2)
1.	Jan. 14 - Feb. 26	20.4
2.	Feb. 27 - Apr. 12	19.3
3.	Apr. 13 - May 28	18.1
4.	May 29 - July 15	16.5
5.	July 16 - Aug. 31	14.5
6.	Sept. 1 - Oct. 15	20.5
7.	Oct. 16 - Nov. 29	22.3
8.	Nov. 30 - Jan. 13	22.0

*Abstracted by R.H.B. Exell, Associate Professor, Energy Technology Division, AIT, and Associate Director, RERIC.

Table 2
Mean hourly global solar radiation at Lae (W/m^2)

Apparent solar time (hours)	Period 1	2	3	4	5	6	7	8
6 - 7	120	-	-	-	-	70	90	100
7 - 8	250	250	210	210	170	220	300	260
8 - 9	430	390	380	380	300	410	490	510
9 - 10	620	510	530	510	420	550	670	760
10 - 11	740	730	660	620	530	670	770	770
11 - 12	780	790	720	660	590	780	830	830
12 - 13	810	780	740	640	600	820	830	810
13 - 14	720	710	650	570	550	760	810	750
14 - 15	570	550	540	460	470	640	630	600
15 - 16	370	370	380	320	230	520	450	410
16 - 17	180	180	190	160	110	240	240	220
17 - 18	40	40	30	20	40	40	70	50

Table 3
Hourly global solar radiation distribution, Jan. 14 – Feb. 25; apparent solar time = clock time – 26 min.

Clock time (hours)	Percentiles (W/m^2) 10th	30th	50th	70th	90th
6 - 7	10	30	50	80	100
7 - 8	70	130	180	230	320
8 - 9	170	250	340	470	580
9 - 10	270	410	560	710	790
10 - 11	430	610	750	860	970
11 - 12	520	620	760	920	1030
12 - 13	540	710	850	950	1050
13 - 14	530	650	780	870	1010
14 - 15	430	570	670	750	850
15 - 16	230	380	470	560	680
16 - 17	120	200	250	320	430
17 - 18	20	50	90	130	180

Table 4
Hourly global solar radiation distribution, Feb. 27 – Apr. 12; apparent solar time = clock time – 20 min.

Clock time (hours)	Percentiles (W/m²)				
	10th	30th	50th	70th	90th
6 - 7	-	-	-	-	-
7 - 8	70	130	170	220	300
8 - 9	160	260	370	480	560
9 - 10	240	460	590	720	790
10 - 11	370	580	720	860	950
11 - 12	470	720	820	970	1020
12 - 13	440	660	840	960	1060
13 - 14	390	620	800	910	1030
14 - 15	340	490	620	730	850
15 - 16	190	330	440	530	670
16 - 17	100	160	220	290	430
17 - 18	10	40	70	90	160

Table 5
Hourly global solar radiation distribution, Apr. 13 – May 28; apparent solar time = clock time – 9 min.

Clock time (hours)	Percentiles (W/m²)				
	10th	30th	50th	70th	90th
6 - 7	-	-	-	-	-
7 - 8	70	130	180	230	290
8 - 9	150	280	360	440	540
9 - 10	240	390	510	620	730
10 - 11	350	560	660	770	870
11 - 12	380	640	750	850	960
12 - 13	470	640	800	900	980
13 - 14	270	590	710	810	880
14 - 15	280	490	610	680	760
15 - 16	160	350	420	490	570
16 - 17	100	150	200	260	340
17 - 18	10	30	50	70	90

Table 6
Hourly global solar radiation distribution, May 29 – July 15; apparent solar time = clock time – 14 min.

Clock time (hours)	Percentiles (W/m^2)				
	10th	30th	50th	70th	90th
6 - 7	-	-	-	-	-
7 - 8	40	110	160	200	270
8 - 9	150	260	350	430	490
9 - 10	220	390	520	620	680
10 - 11	270	490	640	740	810
11 - 12	320	550	740	830	880
12 - 13	320	560	710	810	880
13 - 14	300	490	660	760	850
14 - 15	200	390	540	620	680
15 - 16	180	280	370	440	520
16 - 17	110	160	200	240	300
17 - 18	10	30	50	70	90

Table 7
Hourly global solar radiation distribution, July 16 – Aug. 31; apparent solar time = clock time – 18 min.

Clock time (hours)	Percentiles (W/m^2)				
	10th	30th	50th	70th	90th
6 - 7	-	-	-	-	-
7 - 8	20	60	110	190	270
8 - 9	70	160	230	340	490
9 - 10	120	200	370	530	700
10 - 11	140	300	470	720	860
11 - 12	180	380	590	820	920
12 - 13	240	410	580	850	960
13 - 14	200	420	590	810	880
14 - 15	210	380	530	670	770
15 - 16	140	280	370	460	560
16 - 17	60	150	220	280	360
17 - 18	10	30	50	80	100

Table 8
Hourly global solar radiation distribution, Sept. 1 – Oct. 15; apparent solar time = clock time – 4 min.

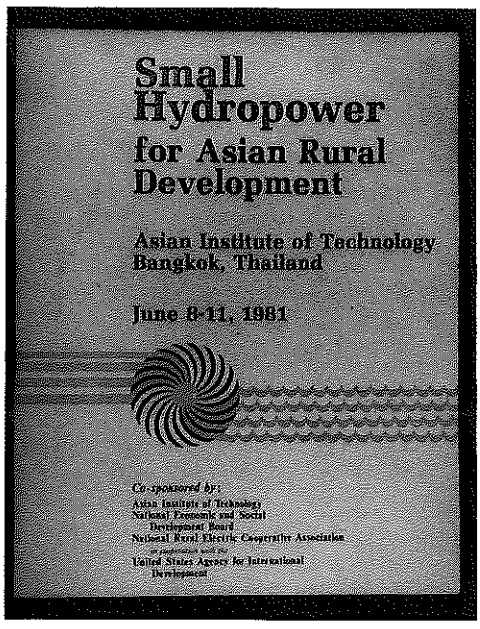
Clock time (hours)	Percentiles (W/m²)				
	10th	30th	50th	70th	90th
6 - 7	10	40	60	80	140
7 - 8	60	140	200	290	470
8 - 9	140	290	540	540	630
9 - 10	210	410	580	720	810
10 - 11	270	600	750	850	940
11 - 12	440	660	840	930	1000
12 - 13	420	770	800	960	1050
13 - 14	430	710	840	920	970
14 - 15	360	620	700	750	790
15 - 16	260	440	510	550	590
16 - 17	130	190	250	300	370
17 - 18	10	30	50	70	90

Table 9
Hourly global solar radiation distribution, Oct. 16 – Nov. 29; apparent solar time = clock time + 4 min.

Clock time (hours)	Percentiles (W/m²)				
	10th	30th	50th	70th	90th
6 - 7	30	80	120	150	180
7 - 8	120	240	330	390	460
8 - 9	290	430	550	620	670
9 - 10	420	610	740	810	870
10 - 11	410	720	850	930	970
11 - 12	490	810	910	950	1000
12 - 13	550	760	920	960	1000
13 - 14	530	810	860	910	970
14 - 15	330	560	600	740	790
15 - 16	210	380	490	540	580
16 - 17	110	160	220	280	360
17 - 18	10	30	50	70	90

Table 10
Hourly global solar radiation distribution, Nov. 30 – Jan. 13; apparent solar time = clock time – 10 min.

Clock time (hours)	Percentiles (W/m^2)				
	10th	30th	50th	70th	90th
6 - 7	10	40	70	100	160
7 - 8	110	170	230	290	370
8 - 9	240	370	470	540	620
9 - 10	410	530	670	740	820
10 - 11	460	650	810	910	970
11 - 12	520	750	910	970	1060
12 - 13	470	700	920	980	1050
13 - 14	420	710	850	930	980
14 - 15	280	550	680	760	850
15 - 16	210	360	480	550	640
16 - 17	110	170	230	290	410
17 - 18	10	40	70	90	160



FOR a general survey of small-scale hydropower technology, and its applications in Asian rural settings, readers may wish to consult the proceedings of a workshop on this topic held at the Asian Institute of Technology, Bangkok, from June 8-11, 1981, which was cosponsored by AIT, The National Economic and Social Development Board of Thailand (NESDB), and the National Rural Electric Cooperative Association (NRECA) of the United States, in cooperation with the U.S. Agency for International Development (USAID).

Small Hydropower for Asian Rural Development (ed. Colin R. Elliott, 360pp.) was published by RERIC on behalf of the NRECA, and presents many of the technological, economic and sociological aspects of introducing small-scale hydropower into the developing countries of Asia. There are also country profiles from the fourteen delegations which were represented at the workshop, and many views from some of the 100 workshop participants are presented in discussion sections following formal presentations. The well-illustrated text should help the reader to form a clear and comprehensive picture of the present state of hydropower in the outlying areas of Asian countries.

These proceedings are being circulated privately by the NRECA, but a limited number of copies are also available from RERIC at US$30 for developed countries and US$22.50 for developing countries (surface mailing costs included).