Mongolia versus selected Australian locations

Overview

This report compares the relative performance of Elixir's proposed renewable energy project combining wind and solar power generation in Mongolia with locations in Western Australia. Our analysis, using publicly available information, indicates the combined wind and solar resources in the Gobi Desert are generally superior to the Pilbara, Southern Goldfields and Mid-West regions of WA, primarily due to higher wind speeds and a wind speed profile that better complements daylight solar generation. We estimate a combined wind and solar utilization of ~79% for the Nomgon project location in Mongolia, compared with ~50-60% for the Southern Goldfields, ~40-45% for the Pilbara and ~53% for the Mid-West. Lower annual average temperatures in the Gobi Desert and the cooling effect of higher average windspeeds help offset to some extent the poorer solar resources, reducing cell temperatures and increasing cell efficiencies. The cooler air temperatures also help to partly offset the lower air density arising from the higher project elevation in Mongolia.

Key points

Model output summary	Units	Mongoli	a Pill	oara		Southern	Goldfields		Mid-West
© K1 Capital Pty Ltd 2021		Nomgor	Port Hedland	Broome	Kalgoorlie	Esperance	Eucla	Forrest	Geraldton
Location									
Latitude:	degrees	44.9	0 -20.31	-17.95	-30.83	-33.86	-31.68	-30.83	-28.80
Longitude:	degrees	110.1	1 118.59	122.23	125.57	121.89	128.90	128.12	114.70
Elevation (h)	m	1,30	2 9	9	370	27	93	159	35
Tmax	degC	20	3 33.3	32.3	25.3	22.3	22.6	26.3	24.6
T min	degC	-9	0 19.5	21.3	11.7	11.3	12.1	11.0	14.4
T mean	degC	3	7 26.4	26.8	18.5	16.8	17.4	18.7	19.5
T amplitude	degC	14	7 6.9	5.5	6.8	5.5	5.2	7.7	5.1
T 9:00 am	degC	-2	3 27.9	27.4	17.3	16.5	19.0	19.6	20.8
T 3:00 pm	degC	4	4 31.2	30.7	24.2	20.1	19.7	24.9	23.0
Solar PV project parameters									
Array tilt	deg vs horiz	48	0 20.0	18.0	31.0	33.8	30.8	30.8	28.8
Average daily irradiation (inclined)	MJ/d/m2	16	9 19.7	19.7	13.7	11.6	8.4	5.0	5.0
Peak irradiance	W/m2	79	8 997	993	815	748	766	766	915
Hours sunlight (sunset-sunrise)	hh:mm	12:	13 12:06	12:06	12:06	12:06	12:06	12:06	12:06
Operating hours per day	hr/day	13	4 12.5	12.4	12.8	12.9	12.6	12.6	12.8
Panel area	На	100	1 100.1	100.1	100.1	100.1	100.1	100.1	100.1
AC peak power generated (1 hr)	MWp	101	9 118.6	119.0	98.5	93.9	95.3	93.4	113.2
Average power generated (per day)	MW	25	7 28.2	28.2	20.2	17.4	20.8	20.6	22.7
Panel area for planned max offtake	На	0	0 0.0	0.0	0.0	0.0	0.0	0.0	0.0
Utilization (average/peak)	%	25.2	% 23.7%	23.7%	20.5%	18.6%	21.8%	22.0%	20.0%
Proportion of solar power to electrolyzer	%	27.8	% 25.9%	30.3%	31.1%	18.0%	23.8%	23.9%	23.4%
Wind project parameters									
Average ambient temperature	degC	3	7 26.4	26.8	18.5	16.8	17.4	18.7	19.5
Average air density	kg/m3	1.0	9 1.18	1.18	1.16	1.21	1.20	1.19	1.20
Average wind speed at hub height	m/s	10	2 5.2	5.7	5.9	7.9	7.8	7.8	7.7
Average Wind Power Density	W/m2	61	0 145	134	134	326	320	315	353
Nominal plant capacity	MW	100	8 100.8	100.8	100.8	100.8	100.8	100.8	100.8
Peak wind power generated (1 hr)	qWM	103	5 100.0	97.0	54.2	103.5	102.0	100.7	101.5
Average wind power generated	MW	69	0 15.0	11.4	9.8	34.3	34.8	34.2	32.6
Average wind turbine power coefficient	-	0.3	3 0.12	0.14	0.16	0.25	0.24	0.24	0.21
Utilization (average/peak)	%	66.7	% 15.0%	11.8%	18.1%	33.1%	34.1%	33.9%	32.1%
Proportion of wind power to electrolyzer	%	93.4	% 73.2%	80.9%	91.3%	71.8%	73.3%	73.5%	69.8%
Combined solar PV and wind									
Peak solar / peak wind ratio	%	98.5	% 118.6%	122.7%	181.8%	90.7%	93.4%	92.7%	111.5%
Average solar / average wind ratio	%	37.2	% 187.6%	247.1%	206.0%	50.8%	59.7%	60.2%	69.5%
Combined wind & solar average/peak	%	48.6	% 21.3%	19.5%	24.0%	26.4%	29.7%	29.8%	25.8%
Power to electrolyzer design ratio	-	2.0	6 4.69	5.12	4.16	3.79	3.37	3.35	3.88
Average electrolyzer utilization	%	79.1	% 43.2%	45.6%	51.8%	55.9%	56.9%	57.0%	52.6%

n.b. the above analysis is based on a common solar array area of 100 Ha and nominal wind capacity of 100 MW for all locations. The electrolyzer capacity is set by the average combined solar and wind capacity relative to the peak for each location. Economic optimization of the relative size of the wind and solar resource components may result in different combined utilizations.

1. Modelling methodology

We have modelled the power generation from wind and solar resources for Elixir's proposed wind and solar project in the Gobi Desert in Mongolia as well as the Pilbara, southern goldfields and Mid-West regions of Western Australia. Our modelling approach is summarized as follows.

- Wind speed, solar irradiance and air temperature profiles by hour of day for each month were sourced from publicly available information (US National Renewable Energy Laboratory¹). These data have been cross-checked with Australia Bureau of Meteorology data where possible.
- 2. Comparisons were based on an installed nominal wind power capacity of 100 MW and solar array area of 100 Ha.
- Wind speeds were estimated for each hour for each month for estimated turbine hub heights (112 m) and solar panel heights (~3 m) based on meteorology station wind speed data (assumed to be ~10 m).
- 4. Ambient temperature was estimated for each hour for each month based on NREL data. This was checked against hourly profiles for each month based on monthly average maxima and minima from BOM data using double-cosine temperature profile models with the timing of maxima and minima linked to sunrise and sunset times. Good agreement was generally observed.
- 5. Air density was estimated for each hour for each month based on site elevation and hourly temperature profiles using the ideal gas equation. No adjustment was made for humidity.
- 6. Wind power density was estimated for each hour for each month (WPD = 0.5 * density * wind speed^3).
- The wind turbine power coefficient was estimated as a function of wind speed, from cut-in speed to cut-out speed based on published wind turbine performance data for the assumed Vestas 136-4.2 turbine. The power coefficient was assumed to increase linearly from cut-in speed to nominal power speed in the absence of detailed power coefficient information.
- 8. Wind power generation was estimated for each hour for each month using WPD, power coefficient and total swept area. Wind power was adjusted for reduction in efficiency at high ambient air temperatures (above 30 deg C).
- 9. Wind power available for sale (for green hydrogen production or offtake) was calculated after making allowance for typical generation losses (auxiliary power consumption 3% and forced outage rate 3%) estimated from public information².
- 10. Solar irradiation information for each hour for each month was obtained from NREL modelling assuming a fixed array inclined to the horizontal at an angle equal to the site latitude.
- 11. Solar cell temperatures were estimated based on solar irradiation, ambient air temperature and wind speed at array height for each hour for each month.

¹ US National Renewable Energy Laboratory, "PV Watts Calculator" estimates the energy production and cost of energy of grid-connected photovoltaic (PV) energy systems throughout the world. This resource provides access to hourly temperature, wind speed and solar resource information for each day of the year, enabling hourly temperature profiles to be generated for each month.

² "AEMO 2019 Costs and Technical Parameter Review - Rev 2", Aurecon, 10 Dec 2019, p 15

- 12. Cell efficiencies were adjusted for cell temperature for each hour for each month.
- 13. Solar power generation was estimated based on solar irradiation, cell efficiency (adjusted for cell temperature) and for each hour for each month. The peak DC generation was determined for each month to determine the installed capacity. The DC generation was adjusted for conversion losses to determine the AC power available for sales or offtake.
- 14. Wind power and solar power output could be directed to hydrogen production or grid offtake. The precedence of wind power or solar power to produce hydrogen was selectable by the user. This does not change the total power generated, just the disposition of the production.
- 15. Wind, solar and combined wind & solar power utilization (i.e. average production / peak production) were estimated for each month.
- 16. The electrolyzer capacity for hydrogen production was based on the ratio of the annual average of the combined solar and wind generation relative of the peak solar and wind generation for each location to avoid over or under-investing in electrolyzer capacity. (One recent study, evaluating only solar power supply to electrolyzers, set the ratio at a fixed 1/1.5 (i.e. 67%)³).
- 17. Wind and solar power supplied to the electrolyzer up to the electrolyzer capacity limit for each hour for each month, with surplus wind and or solar power directed to grid sales.
- 18. Wind and solar power production and disposition (i.e. electrolyzer vs grid sales) were plotted for each hour for each month and annual average to enable inspection of trends or outliers.
- 19. Ambient temperature, wind speed, wind power generation, solar irradiance, cell temperature and solar power generation profiles were plotted for each hour for each month.
- 20. Key statistics were tabulated for each project to enable comparison of project performance.



Figure 1 Estimated wind power coefficient and wind turbine power curves

³ Source: Jonathon Yates, Rahman Daiyan, Robert Patterson, Renate Egan, Rose Amal, Anita Ho-Baille, Nathan L. Chang, "Techno-economic Analysis of Hydrogen Electrolysis from Off-Grid Stand-Alone Photovoltaics Incorporating Uncertainty Analysis", Cell Reports Physical Science 1, 100,209, October 21, 2020

2. Nomgon IX PSC Project

We were not able to locate reliable solar information by hour and month for the Nomgon IX PSC area. We used NREL data for Ulaanbaatar, which was the nearest location with suitable solar data. We were able to locate wind data by hour and month for Dalanzadgad, located within or close to the PSC area. These graphical data were digitized. Key results are shown below.



Figure 2 Nomgon IX estimated profiles

Notes: Wind speed at anemometer reference height (not turbine hub height). Wind power density at turbine hub height

Nomgon-IX PSC	Units	-	Total	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
© K1 Capital Pty Ltd 2021		•		1	2	3	4	5	6	7	8	9	10	11	12
Wind Power Generated (gross)															
1:00	MW		67.0	68.4	74.8	49.4	94.6	77.3	59.1	26.7	19.9	47.5	89.8	98.5	100.1
2:00	MW		69.8	84.0	74.9	58.3	95.5	90.4	49.5	37.2	15.6	38.0	94.6	99.0	100.6
3:00	MW		70.0	76.9	79.7	78.7	96.1	79.9	38.7	31.9	15.1	47.9	95.6	99.8	101.1
4:00	MW		70.0	103.1	84.9	79.5	96.9	76.8	28.8	18.2	11.6	57.1 61.5	83.9	100.6	101.5
6:00	MW		71.6	103.4	79.6	100.3	97.0	75.1	35.6	12.8	14.6	56.8	81.5	100.8	102.0
7:00	MW		74.8	103.5	77.1	99.7	96.6	90.5	45.3	22.7	26.9	52.8	80.0	100.8	102.0
8:00	MW		81.3	103.1	73.2	98.2	95.4	91.9	71.5	30.2	32.2	92.9	86.1	99.6	101.
9:00	MW		81.0	101.7	78.8	96.1	93.7	90.6	71.2	28.2	30.3	91.6	93.0	97.6	100.4
11:00	MW		77.6	99.0	95.6	92.0	90.0	87.7	49.6	19.9	33.7	88.5	89.9	93.0	96.8
12:00	MW		77.1	95.7	93.7	90.6	88.5	86.6	51.9	17.9	39.5	87.2	89.0	91.6	95.
13:00	MW		77.4	94.9	93.1	89.9	87.5	85.9	61.7	20.5	36.4	86.3	88.7	91.1	94.
14:00	MW		77.2	94.8	93.0	89.9	87.1	85.6	63.3	20.9	33.4	86.0	88.8	91.2	94.
15:00	MW		78.9	95.0	93.2	90.1	87.2	85.7	81.8	20.2	34.9	86.1	89.0	91.4	95.
17:00	MW		67.1	54.8	63.0	91.0	87.8	86.3	83.2	20.2	54.7	86.6	59.4	49.1	66.
18:00	MW		58.0	41.5	24.0	91.6	88.4	86.8	84.5	37.2	50.7	53.7	30.6	37.5	67.
19:00	MW		53.8	51.7	21.8	52.3	89.1	87.5	69.6	41.7	31.2	30.7	29.1	42.7	96.
20:00	MW		48.5	51.6	24.2	31.3	72.0	66.3	60.8	39.4	18.6	31.2	32.7	55.5	97.
21:00	MW		49.4	49.9	38.6	37.8	80.6	44.4	46.0	32.2	17.0	37.8	53.3	57.7	97.
22:00 23:00	MW		61.7	62.0	60.4	45.9	92.8	49.2	64.0	35.9	20.2	44.3	71.7	91.9	98.
0:00	MW		64.3	67.4	70.4	51.8	93.7	61.0	51.8	31.7	22.3	48.6	77.2	97.7	99.
Average wind power generated	MW		69.0	80.7	71.5	75.9	90.8	78.0	57.8	26.4	27.2	64.1	77.0	84.4	95.2
Peak wind power generated (1 hr)	MWp		103.5	103.5	95.6	100.3	97.0	91.9	84.5	41.7	54.7	92.9	95.6	100.8	102.0
Cell/module temperature															
1:00	degC			-26	-24	-17	-9	0	5	13	12	3	-7	-20	-25
2:00	degC			-28	-27	-20	-11	-2	4	11	10	1	-9	-22	-26
3:00	degC			-30	-29	-22	-14	-4	2	10	9	-1	-11	-24	-28
4:00	degC			-32	-30	-24	-15	-5	2	10	8	-3	-11	-25	-29
5:00	degC degC			-33	-31	-24	-16	-5 -4	1	10	8	-4 -4	-12	-26	-30
7:00	degC			-34	-32	-23	-14	-1	6	13	9	-3	-11	-26	-31
8:00	degC			-34	-29	-18	-8	5	12	17	13	0	-7	-23	-30
9:00	degC			-30	-22	-8	3	14	21	24	21	9	2	-16	-26
10:00	degC			-19	-9	4	15	24	31	32	29	20	14	-3	-17
12:00	degC			-/	4	25	33	38	46	44	41	37	31	18	-3
13:00	degC			8	18	29	37	42	50	47	45	41	33	21	6
14:00	degC			7	16	28	35	42	50	46	45	41	31	20	5
15:00	degC			6	14	26	36	40	48	45	45	40	28	17	3
16:00	degC			2	10	21	33	36	44	42	42	36	22	12	-1
18:00	degC			-11	-2	8	19	25	33	33	37	25	10	-0	-12
19:00	degC			-13	-7	1	13	19	27	28	26	20	7	-3	-14
20:00	degC			-15	-10	-2	9	16	22	24	23	16	5	-6	-16
21:00	degC			-17	-13	-5	5	13	18	21	21	14	2	-8	-18
22:00	degC			-19	-16	-8	2	10	15	19	18	11	-1	-11	-20
0:00	degC			-24	-22	-15	-6	3	8	15	10	5	-5	-18	-23
Average	degC			-17	-11	-2	7	16	22	25	24	15	6	-7	-16
Max	degC			8	18	29	37	42	50	47	45	41	33	21	
Gross AC power generated															
1:00	MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2:00	MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3:00	MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4:00	MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5:00	MW		0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0
7:00	MW		2.2	0.0	0.0	0.1	2.7	6.7	7.8	5.7	3.0	0.7	0.0	0.0	0.0
8:00	MW		8.6	0.0	0.1	4.3	17.4	20.8	18.9	15.2	13.0	10.9	2.1	0.1	0.0
9:00	MW		25.1	0.5	9.4	28.4	48.1	42.4	38.2	33.2	32.1	34.7	24.0	9.0	0.5
10:00	MW		49.9	26.4	42.8	56.7	78.4	61.3	55.7	51.1	50.8	59.0	55.2	37.7	24.5
11:00	MW		69.4 84 4	54.3 79.6	73.8	74.8 94.3	88.8	71.9	67.9 79.1	64.5 73.1	64.9 74 7	75.8	94.2	61.8 70 5	55.0
13:00	MW		88.8	87.5	96.3	101.9	101.4	87.8	83.5	75.2	77.6	90.2	98.3	86.2	80.4
14:00	MW		83.0	84.1	89.1	97.6	87.3	82.7	80.9	70.0	73.6	84.7	91.2	82.0	73.3
15:00	MW		77.5	77.1	84.5	91.6	90.2	75.4	75.3	66.1	74.2	80.6	79.2	70.6	66.4
16:00	MW		62.1	57.9	69.2	77.1	80.9	62.4	63.3	56.1	65.7	65.9	57.4	46.3	43.8
17:00	MW		37.7	25.7	43.5	54.9	51.7	44.7	46.8	41.5	49.9	43.8	29.2	13.7	7.
18:00	MW		19.1	0.7	14.4	29.8 4 0	54.9 10.8	28.8	14.0	14 1	11.8	4 1	0.1	0.2	0.0
20:00	MW		1.5	0.0	0.0	0.0	1.2	3.5	5.4	5.0	2.5	0.1	0.0	0.0	0.0
21:00	MW		0.2	0.0	0.0	0.0	0.0	0.3	1.1	0.8	0.1	0.0	0.0	0.0	0.
22:00	MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23:00	MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total solar power generated	MW		25.7	20.6	25.6	29.8	0.0 33.1	28.5	28.0	0.0 25.1	26.0	27.5	25.7	20.3	171
Peak solar power generated (1 br)	MW	101.0	101.0	87.5	96.3	101.0	101.4	87.8	02.5	75.2	77.6	90.2	09.2	26.3	20.4

Figure 3 Nomgon-IX PSC power generation

3. Pilbara location

We based our estimates on BOM and NREL information for Port Hedland and Broome. The wind speed data suggest the Pilbara is not a particularly suitable location for wind generation (low windspeed during nighttime), however, individual sites may have different characteristics.





Notes: Wind speed at anemometer reference height (not turbine hub height). Wind power density at turbine hub height. Daily gross power profile is DC power from solar PV.

Port Hedland	Units		Total	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
© K1 Capital Pty Ltd 2021		7		1	2	3	4	5	6	7	8	9	10	11	12
Wind Power Generated (gross)															
1:00	MW		0.0	0.3	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
2:00	MW		0.1	0.1	0.0	0.0	0.0	0.0	0.4	0.1	0.0	0.0	0.0	0.0	0.0
3:00	MW		0.1	0.4	0.0	0.0	0.0	0.0	1.1	0.3	0.0	0.0	0.0	0.0	0.0
5:00	MW		0.1	0.0	0.0	0.0	0.4	0.2	2.0	1.0	0.0	0.0	0.0	0.0	0.0
6:00	MW		0.3	0.0	0.0	0.0	0.6	0.2	2.1	1.0	0.0	0.0	0.0	0.0	0.0
7:00	MW		2.0	0.0	0.0	0.0	3.9	1.9	9.9	4.3	3.9	0.4	0.2	0.0	0.
8:00	MW		6.1	0.5	0.2	0.0	14.5	5.5	21.3	8.9	17.2	3.1	1.8	0.2	0.
9:00	MW		25.8	2.4	2.2	1.1	51.1	25.6	66.4	34.5	72.6	23.8	19.2	6.3	3.
10:00	MW		23.5	4.0	2.4	1.4	42.9	25.2	61.9	25.2	74.1	16.8	12.7	8.1	6.
11:00	MW		37.0	14.1	9.3	6.8	60.3	36.7	78.7	36.8	100.0	33.1	23.6	23.6	19.
12:00	MW		29.9	31.9	13.9	12.9	36.9	21.8	47.8	19.3	72.4	25.0	12.5	29.2	35.
13.00	MW		51.7	94.2	42.1	37.9	30.5	27.6	34.5	24.6	56.3	64.0	29.8	95.0	83
15:00	MW		50.2	95.0	51.3	35.6	22.4	27.5	27.2	27.5	41.5	66.5	33.9	95.4	79.
16:00	MW		33.1	95.4	39.2	27.3	4.3	4.9	5.1	4.1	9.1	37.2	10.1	90.5	70.
17:00	MW		21.6	95.9	18.0	14.0	0.2	0.8	0.5	0.0	1.2	20.8	3.4	58.1	46.
18:00	MW		15.4	85.7	15.3	7.9	0.0	0.0	0.0	0.0	0.0	12.6	0.7	29.0	33.
19:00	MW		6.2	43.1	4.7	1.0	0.0	0.0	0.0	0.0	0.0	3.7	0.0	10.8	10.
20:00	MW		2.2	19.3	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	2.6	2.
21:00	MW		0.7	7.8	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.
22:00	MW MM		0.3	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
23:00			0.1	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average wind nower generated			15.0	27.3	9.6	7.2	13.2	9.0	17.6	9.2	22.5	15.4	7.6	22.2	19
Peak wind power generated (1 hr)	MWp		100.0	95.9	51.3	37.9	60.3	37.6	78.7	36.8	100.0	66.5	35.1	95.4	83.
Call/madula tomporatura															
1.00	degC			27	28	28	25	20	17	16	18	19	23	25	2
2:00	degC			27	28	27	24	19	16	15	17	19	22	24	26
3:00	degC			26	27	27	23	19	15	14	16	17	21	23	26
4:00	degC			26	27	26	22	18	15	13	16	17	21	23	20
5:00	degC			26	27	26	22	18	14	13	15	17	20	24	20
6:00	degC			28	27	26	22	18	14	13	14	18	23	28	29
7:00	degC			34	32	30	23	19	14	14	15	21	29	35	36
8:00	degC			41	37	37	28	22	16	16	19	28	36	42	43
9:00	degC			48	43	43	34	28	21	21	25	34	42	48	49
10:00	degC			54	50	49	41	34	28	29	32	42	50	55	54
11:00	degC			58	54	53	45	38	32	34	3/	4/	55	58	58
12:00	degC			50	56	54	49	41	35	37	41	10	56	58	55
14:00	degC			56	53	52	47	39	35	36	40	47	54	55	56
15:00	degC			51	49	49	44	36	32	33	37	43	49	50	53
16:00	degC			46	45	44	40	33	29	30	34	38	44	45	47
17:00	degC			40	40	39	35	29	26	26	29	30	36	38	41
18:00	degC			32	32	32	33	28	25	25	26	26	30	29	3:
19:00	degC			28	31	32	32	27	25	24	25	25	29	28	30
20:00	degC			28	31	33	32	27	24	23	24	25	29	28	30
21:00	degC			28	31	32	30	25	22	22	23	24	28	28	30
22:00	degC degC			28	30	31	29	24	21	21	22	23	26	27	25
23:00	degC			28	30	30	28	23	20	19	10	22	25	20	20
Average	degC			38	37	37	33	27	23	23	25	20	35	37	38
Max	degC			59	56	55	49	41	36	37	41	50	57	60	59
C AC															
1.00	MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0 (
2:00	MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3:00	MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4:00	MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5:00	MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6:00	MW		2.8	3.9	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	4.7	13.1	9.
7:00	MW		15.5	27.2	16.1	11.1	5.3	3.1	2.2	2.6	3.5	11.9	27.6	38.7	36.
8:00	MW		33.8	51.4	37.7	35.0	22.8	12.5	6.4	7.7	17.3	35.5	53.1	64.4	62.4
9:00			55.0	76.6	60.6	56.9	44.8	32.8	24.2	25.7	38.8	58.7	75.6	85.0	81.2
10:00			12.1	95.1	78.9	73.3	74.5	48.8	40.3	42.4	50.2	70.3	93.5	112.8	96.
12:00	MW		90.3	116.7	101.6	92.6	79.7	64.0	57.8	61.4	75.6	92.5	105.2	117.3	115
13:00	MW		90.1	118.6	101.2	90.8	79.5	64.4	56.9	62.1	73.8	94.4	107.6	116.1	115
14:00	MW		83.0	109.7	92.6	87.2	72.4	57.3	50.5	55.3	69.3	87.0	99.5	107.6	108.
15:00	MW		70.0	95.4	78.3	76.0	58.4	44.0	37.2	43.4	56.9	73.0	85.4	94.4	97.
16:00	MW		50.6	77.2	61.4	56.2	37.9	25.9	20.1	26.8	37.7	51.8	62.2	72.7	77.
17:00	MW		24.6	52.2	39.1	31.7	11.8	3.6	3.0	4.3	11.2	18.3	24.3	45.4	50.
18:00	MW		3.5	17.1	7.9	3.3	0.5	0.0	0.0	0.0	0.3	1.0	1.4	3.5	7.
19:00	MW		0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
20:00	MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
21:00	MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
22:00			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23:00	MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total solar power generated	MW		28.2	39.6	32.1	29.2	22.9	17.3	14.6	16.1	21.2	28.7	35.4	40.6	40.3
Peak solar power generated (1 hr)	MW	118.6	118.6	118.6	101.6	02.6	70.7	64.4	57.9	62.1	75.6	04.4	109.0	117.2	115.0

Figure 5 Pilbara power generation: Port Hedland

The data for Broome are similar to Port Hedland.





Notes: Wind speed at anemometer reference height (not turbine hub height). Wind power density at turbine hub height.

Figure / Filbara power	generation	I. DI UU	me											
Broome © K1 Capital Pty Ltd 2021	Units	Total	Jan 1	Feb 2	Mar 3	Apr 4	May 5	Jun 6	Jul 7	Aug 8	Sep 9	Oct 10	Nov 11	Dec 12
Wind Davies Commented (mass)														
1:00 MV	N	1.6	3.4	1.0	0.2	0.0	0.0	0.7	0.0	0.3	0.0	0.0	6.1	7.8
2:00 MV	N	1.5	3.4	0.8	0.4	0.0	0.0	0.8	0.0	0.4	0.1	0.0	5.8	6.7
3:00 MV	N	1.3	3.7	1.0	0.8	0.0	0.0	1.0	0.1	0.8	0.3	0.1	4.5	3.0
4:00 MV	N	1.2	3.0	0.4	0.7	0.0	0.0	0.9	0.1	0.4	0.1	0.0	4.5	4.7
6:00 MV	N	1.2	2.5	0.0	0.9	0.0	0.0	2.2	0.2	0.3	0.5	0.1	4.1	4.1
7:00 MV	N	2.1	2.8	0.0	1.8	0.0	0.4	5.8	1.2	1.4	1.0	0.7	5.5	5.1
8:00 MV	N	4.7	4.0	0.9	3.6	1.2	2.9	11.9	3.7	4.2	3.2	3.6	8.6	8.4
9:00 MV	N	12.5	8.6	6.0	9.4	6.0	9.2	22.6	12.8	11.8	12.0	12.6	19.9	18.8
10:00 MV	N	15.1	10.0	5.9	8.0	8.3	11.9	29.8	12.4	14.0	11.8	16.7	26.8	24.9
12:00 MV	N	23.8	15.4	15.2	87	15.0	10.4	32.1	14.6	25.7	19.2	28.9	45.1	41.3
13:00 MV	N	37.9	27.4	27.2	14.2	25.5	16.6	27.4	21.7	42.3	30.8	52.5	86.9	82.1
14:00 MV	N	38.3	29.5	31.8	12.9	22.8	12.3	18.2	17.3	42.5	30.9	54.0	94.2	93.5
15:00 MV	N	37.8	32.6	29.8	12.3	21.4	10.0	10.3	14.5	38.1	30.2	60.4	97.0	96.7
16:00 MV	N	25.0	21.6	18.3	6.6	10.3	3.8	5.1	6.3	25.5	18.2	34.3	70.2	79.8
17:00 MV	N	16.3	15.3	7.7	3.6	4.0	0.8	2.4	2.5	16.1	11.1	21.3	48.8	61.0
18:00 MV	N	9.7	8.5	6.4	2.0	1.8	0.2	1.4	1.3	8.7	5.4	9.4	26.8	42.9
20:00 MV	N	3.5	4.2	0.4	0.8	0.0	0.0	0.9	0.5	4.5	2.0	1.8	19.0	19.1
21:00 MV	N	2.2	3.8	0.2	0.0	0.0	0.0	1.0	0.0	1.3	0.4	1.1	8.9	9.6
22:00 MV	N	2.0	3.0	0.3	0.0	0.0	0.0	1.1	0.0	0.7	0.1	0.3	7.5	11.1
23:00 MV	N	1.8	3.4	0.6	0.1	0.0	0.0	1.0	0.0	0.2	0.1	0.1	6.9	9.3
0:00 MV	N	2.4	3.5	1.0	0.3	0.0	0.0	1.2	0.2	0.2	0.2	0.1	8.2	14.0
Average wind power generated MV	N	11.4	9.8	7.1	4.1	5.5	4.1	9.0	5.4	11.3	8.2	13.9	28.0	30.2
Peak wind power generated (1 hr) MV	Vp	97.0	32.6	31.8	14.2	25.5	16.6	35.1	21.7	42.5	30.9	60.4	97.0	96.7
Cell/module temperature														
1:00 deg	gC		26	26	27	25	22	17	17	18	21	24	24	25
2:00 deg	gC		25	26	26	25	21	17	16	17	20	24	24	25
3:00 deg	gC		25	26	25	24	20	16	15	16	19	23	24	25
4:00 deg	gC		25	26	25	24	20	16	15	16	19	23	24	25
5:00 deg	gC		25	27	25	24	20	15	14	15	19	23	24	25
6:00 deg	gC rC		28	2/	26	24	20	15	15	16	20	26	29	28
7.00 deg 8:00 deg	sc sc		38	35	35	33	21	20	21	24	31	32	42	41
9:00 deg	zC		44	40	41	39	32	27	27	31	38	44	48	45
10:00 deg	gC		50	46	47	45	38	33	34	38	45	49	53	51
11:00 deg	gC		54	49	51	48	42	38	39	42	49	52	56	54
12:00 deg	gC		56	52	54	50	44	40	42	45	51	53	57	56
13:00 deg	gC		54	51	53	49	43	40	41	44	49	52	55	55
14:00 deg	gC		51	49	51	48	42	38	39	42	47	49	52	52
15:00 deg	gC aC		47	40	47	30	30	30	30	30	42	44	40	40
17:00 deg	zC		37	36	36	34	30	27	27	28	30	31	33	36
18:00 deg	gC		31	30	31	30	28	25	25	24	26	28	28	29
19:00 deg	gC		29	29	30	30	27	24	24	24	26	27	27	27
20:00 deg	gC		28	30	30	30	26	23	23	23	25	27	27	27
21:00 deg	gC		28	29	30	29	25	22	22	22	25	26	26	27
22:00 deg	gC		27	29	29	28	24	20	21	21	24	26	26	26
23:00 deg	gC T		27	28	28	27	24	19	19	20	23	25	25	26
	<u>sc</u>		36	35	35	33	23	25	25	26	30	34	35	36
Max deg	gC		56	52	54	50	44	40	42	45	51	53	57	56
Gross AC power generated	N	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.00 MV	N	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3:00 MV	N	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4:00 MV	N	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5:00 MV	N	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6:00 MV	N	4.5	9.0	1.2	1.7	0.0	0.0	0.0	0.0	0.0	2.8	10.0	18.0	11.7
7:00 MV	N	16.9	28.6	13.3	14.9	8.0	3.4	3.3	3.6	5.7	15.6	30.8	41.8	33.3
8:00 MV	N N	36.7	47.9	33.9	36.0	29.8	18.9	13.7	14.8	24.3	38.4	56.1	67.4	58.8
9:00 MV 10:00 MV	N	57.9 75 Q	91.5	72.3	75.8	69.5	55.7	50.5	52.7	64.2	81.1	93.7	107.0	97 /
11:00 MV	N	87.4	105.8	84.4	90.9	78.3	65.7	61.8	64.8	76.1	91.5	103.4	116.0	109.9
12:00 MV	N	92.5	110.8	96.4	96.3	83.9	69.7	65.4	69.8	82.3	97.0	105.3	119.0	114.2
13:00 MV	N	90.9	107.9	94.4	94.0	83.3	66.7	64.7	69.2	81.5	92.4	105.0	117.7	113.7
14:00 MV	N	81.9	95.4	89.3	86.5	76.1	59.1	55.7	61.4	72.7	83.9	93.3	104.4	105.3
15:00 MV	N	66.1	79.5	75.8	71.5	60.4	44.7	41.9	46.9	58.6	66.6	74.2	84.0	89.5
16:00 MV	N	44.4	59.3	53.7	50.7	40.3	25.6	22.7	27.0	37.8	42.0	48.3	57.5	68.
1/:00 MV	N N	19.2	30.3	28.0	24.5	15.4	0.1	4.0	6.3	13.2	14.2	18.5	25.5	38.
18:00 MV 19:00 MV	N	2.7	0.0	0.0	2.7	0.7	0.1	0.0	0.0	0.4	0.0	0.4	1.0	0.0
20:00 MV	N	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21:00 MV	N	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22:00 MV	N	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23:00 MV	N	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0:00 MV	N	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I otal solar power generated MV	N	28.2	35.6	29.3	29.3	24.9	18.9	17.4	18.8	23.5	28.7	34.1	39.5	38.5
reak solar power generated (1 nr) MV	119.0	119.0	110.8	90.4	90.3	63.9	09.7	05.4	09.8	62.3	97.0	102.3	113.0	114.2

Figure 7 Pilbara power generation: Broome

4. Southern Goldfields location

We based our estimates on BOM and NREL information for Esperance, Kalgoorlie and Forrest.





Notes: Wind speed at anemometer reference height (not turbine hub height). Wind power density at turbine hub height. Daily gross power profile is DC power from solar PV.

5.6

5.3

5.6

4.8

4.4

5.0

6.8

13.1

24.4

43.3

74.5

100.8

100.8 100.9

101.1

101.4

101.7

77.9

40.5

23.5

12.3

9.8

7.7

40.7

12

11

11

11

12

15

20

25

30

33 35

36

35

35

33

30

26

18

16

15

15

14 13

12

21

36

0.0

0.0

0.0

0.0

0.3

7.8

24.2

42.2

56.9

66.0

74.4

79.1 80.0

80.7

75.2

63.1

47 4

12.0

0.1

0.0

0.0

0.0

0.0

0.0

29.6

80.7

101.7

18.8

16.6

15.8

13.4

11.9

10.1

14.7

22.8

45.9

60.7

97.0

100.2

100.2 100.3

100.5

100.7

101.1

101.5

69.6

47.7

29.5

27.2

22.9

23.4

52.2

101.5

12

12

11 12

13

18

24

29

34

38 40

41

40

38

35

31

27

21

17

16

15

14 13

12

23

41

0.0

0.0

0.0

0.0

2.3

19.7

38.2

56.9

71.1

85.1

90.0

93.9 92.6

87.2

77.3

62.7

44 3

19.5

1.5

0.0

0.0

0.0

0.0

0.0

35.1

93.9

Renewable resource comparison

May Wind Power Generated (gross) 1:00 MW 11.2 8.4 10.9 7.3 3.7 7.3 12.7 20.1 21.7 8.5 8.9 2:00 MW 12.5 7.1 6.0 4.6 8.4 14.7 27.1 9.8 9.6 30.6 9.9 3:00 MW 13.2 6.5 9.9 6.5 4.4 9.1 15.6 21.7 37.6 8.4 16.2 4:00 MW 12.7 4.7 7.7 5.1 4.9 9.8 12.3 29.5 35.9 9.6 14.0 5:00 MW 13.0 3.8 7.3 5.1 4.4 11.7 10.3 28.3 38.6 10.3 18.5 6:00 MW 15.0 3.3 6.7 5.3 5.5 15.9 12.4 40.5 44.6 11.8 17.5 7:00 MW 17.9 5.7 10.4 8.7 5.3 16.2 13.9 49.5 16.6 35.9 29.5 31.6 34.2 8:00 MW 25.0 10.5 17.0 14.4 7.4 20.0 20.9 64.2 25.8 50.4 29.1 77.7 45.4 38.4 23.2 12.7 85.3 9:00 MW 34.1 26.6 20.6 10:00 MW 50.8 39.4 52.6 40.0 15.6 32.0 45.4 45.2 92.4 54.6 87.8 11:00 MW 71.4 69.9 88.7 62.4 24.1 37.8 67.5 58.3 103.5 70.9 101.9 12:00 MW 80.5 99.6 99.7 84.1 23.6 47.1 83.7 54.8 103.2 67.6 101.7 99.6 99.7 99.7 99.7 100.2 100.2 54.0 39.4 97.8 77.0 13:00 MW 82.1 37.5 46.3 66.5 80.6 101.7 14:00 MW 36.6 48.0 53.8 76.5 69.0 93.7 99.9 100.1 15:00 MW 71.6 99.8 100.4 42.4 52.9 34.9 37.6 60.6 58.5 71.7 16:00 MW 59.1 100.1 100.6 34.5 21.4 35.9 16.0 14.5 32.4 53.3 17:00 MW 49.5 88.9 100.4 81.3 13.1 27.5 4.0 5.3 17.5 20.0 36.3 18:00 MW 38.4 66.9 91.7 55.5 5.1 13.9 1.8 2.4 7.7 12.9 27.0 24.6 3.8 2.0 6.7 19:00 MW 36.2 57.2 39.8 15.0 1.3 8.3 16.7 26.8 19.1 20:00 MW 16.6 23.0 36.5 2.2 11.5 1.8 2.6 5.8 8.9 5.8 12.2 21:00 MW 11.7 12.6 24.5 1.6 9.3 3.9 5.3 4.8 9.2 22:00 MW 10.2 11.9 17.6 13.0 1.6 8.1 4.1 6.2 8.5 5.4 8.8 23:00 MW 10.0 10.1 14.0 10.0 2.0 7.7 6.5 12.6 11.1 6.6 8.4 0:00 MW 10.3 10.9 7.9 11.0 7.3 3.4 6.1 10.4 23.6 14.1 7.5 Average wind power generated MW 34.3 39.2 46.1 38.6 12.0 21.6 22.6 26.1 43.7 27.2 41.4 103.5 MWp 100.1 100.4 100.6 42.4 52.9 58.3 103.5 101.9 Peak wind power generated (1 hr) 83.7 80.6 Cell/module temperature 1:00 degC 15 15 15 14 10 2:00 degC 15 10 14 14 13 3:00 degC 14 14 14 14 14 12 10 7 8 8 14 4:00 degC 12 5:00 degC 15 14 14 12 19 16 14 6:00 degC 12 11 8 7:00 degC 24 29 20 25 17 14 10 10 15 8:00 degC 21 17 12 9 8 14 19 8 9:00 degC 34 30 25 18 23 15 12 11 11 20 27 30 10:00 degC 37 41 34 37 29 32 24 18 20 14 13 15 15 17 21 24 11:00 degC 26 16 12:00 degC 42 41 40 39 39 37 33 32 31 28 21 16 17 18 25 24 23 31 13:00 degC 27 21 17 16 18 30 29 14:00 degC 26 19 16 16 18 15:00 degC 38 34 35 32 27 22 29 26 22 19 24 18 17 16 15 15 16 21 19 26 23 15 16:00 degC 15 22 17:00 degC 30 24 20 16 15 15 14 14 14 14 16 14 19 16 16 18:00 degC 20 19:00 degC 20 19 19 15 15 14 13 14 15 18 18 17 19 13 13 14 20:00 degC 19 18 14 14 12 18 18 14 12 11 13 13 21:00 degC 18 11 22:00 degC 17 17 17 17 17 13 12 12 11 11 10 11 10 12 11 23:00 deg0 16 16 16 9 0:00 degC 16 12 11 Average deg 25 24 21 19 14 12 11 11 14 17 Max degC 42 39 33 17 17 18 25 28 21 31 Gross AC power generated 1:00 MW 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 2:00 MW 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 3:00 MW 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 4:00 MW 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 5:00 MW 0.3 0.4 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.1 6:00 MW 12.7 0.0 1.0 4.5 3.6 0.7 0.0 0.0 0.0 0.0 8.2 7:00 MW 13.5 32.8 18.9 8.3 3.5 1.6 0.4 0.4 2.1 7.6 23.9 8:00 MW 24.2 47.6 34.7 21.5 9.3 6.0 4.7 5.1 7.5 18.6 36.4 9:00 MW 34.8 61.8 50.4 18.0 10.8 9.8 10.3 14.6 31.3 34.5 48.9 10:00 MW 43.1 72.9 61.0 45.7 25.1 15.4 13.4 15.0 21.7 38.8 58.2 18.3 11:00 MW 49.8 84.2 72.2 52.2 31.0 19.1 16.6 26.3 48.3 65.6 88.8 87.4 80.5 81.5 56.1 55.2 33.5 34.3 15.9 16.2 20.0 17.1 29.2 27.2 49.0 45.4 65.2 62.8 12:00 MW 52.7 22.2 13:00 MW 51.5 20.3 14:00 MW 48.0 86.7 76.6 51.8 29.9 15.9 13.3 13.5 23.0 40.2 58.4 79.5 67.8 9.7 5.0 15:00 MW 40.9 43.8 22.4 11.6 9.2 16.3 32.5 47.4 63.8 55.1 4.2 8.8 16:00 MW 30.2 31.1 11.4 5.8 20.6 32.3 17:00 MW 18.5 46.7 36.4 16.0 3.6 09 04 0.8 2.6 7.4 17.1 18:00 MW 21.7 13.3 2.6 0.2 0.0 0.0 0.0 0.5 2.2 6.0 0.0 19:00 MW 0.3 1.8 0.0 0.6 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 20:00 MW 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 21:00 MW 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 22:00 MW 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 23:00 MW 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0:00 MW 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Total solar power generated мw 17.4 32.9 27.2 17.5 9.3 5.4 4.3 4.8 7.5 14.2 21.9 Peak solar power generated (1 hr) 34.3 22.2 MW 93.9 88.8 81.5 56.1 16.6 20.0 29.2 49.0 65.6

Figure 9 Southern Goldfields power generation: Esperance

The data indicate significant differences in wind and solar resources across the project area.





Notes: Wind speed at anemometer reference height (not turbine hub height). Wind power density at turbine hub height

Kalgoorlie © K1 Capital Pty Ltd 2021	Units		Total	Jan 1	Feb 2	Mar 3	Apr 4	May 5	Jun 6	Jul 7	Aug 8	Sep 9	Oct 10	Nov 11	Dec 12
Wind Power Generated (gross)															
wind Power Generated (gross)	1:00 MW		6.1	26.2	9.3	4.1	2.4	0.5	0.7	0.5	0.8	1.4	5.4	6.6	15.3
	2:00 MW		5.9	25.6	8.4	3.4	2.4	0.3	0.5	0.5	0.5	0.8	4.3	6.8	17.1
	3:00 MW		5.2	17.7	7.7	3.2	3.4	0.2	0.2	0.5	0.4	0.9	4.1	7.0	16.7
	4:00 MW		5.6	24.5	6.2	2.8	1.7	0.0	0.2	0.2	0.2	0.4	3.3	7.4	20.4
	6:00 MW		5.5	23.3	4.8	2.8	1.8	0.1	0.1	0.2	0.2	0.5	3.2	7.5	21.7
	7:00 MW		6.4	20.1	6.0	4.3	3.1	0.7	0.4	0.7	0.7	1.7	6.6	9.4	23.3
	8:00 MW		8.4	18.2	9.1	6.5	5.7	2.0	1.2	2.0	5.0	4.7	9.9	10.4	25.7
	9:00 MW		14.8	18.6	17.1	13.6	14.6	6.0	4.7	5.4	19.4	14.2	19.2	13.9	30.5
1	10:00 MW		14.4	13.3	15.1	9.7	10.7	8.4	7.4	7.7	24.4	18.9	16.6	12.6	27.7
1	12:00 MW		18.6	11.4 8.1	18.6	10.6	12.4	12.3	13.2	11.5	43.6	28.9	18.7	13.6	28.0
1	13:00 MW		21.1	9.0	23.3	9.4	9.8	12.5	21.7	14.1	54.2	39.1	18.2	15.1	27.4
1	4:00 MW		18.2	8.7	22.3	8.0	6.5	9.0	19.4	11.2	42.3	34.8	15.9	15.1	25.0
1	15:00 MW		16.6	8.6	22.6	5.8	5.0	7.6	19.3	7.7	35.1	33.3	16.7	15.9	21.8
1	16:00 MW		10.7	10.1	16.9	5.7	2.4	2.7	7.4	4.0	14.1	18.4	12.3	14.1	20.5
1	17:00 MW		8.3	12.0	14.7	5.4	1.2	1.3	3.3	2.0	6.7	12.0	10.7	13.1	17.0
1			8.0	19.7	14.2	8.6	1.3	0.3	0.8	0.9	2.7	5.8	10.5	12.9	19.0
1	20:00 MW		6.2	21.1	8.2	5.8	1.0	0.4	0.2	0.3	0.8	4.0	11.1	9.3	11.7
2	21:00 MW		5.1	15.3	8.3	3.7	1.0	0.7	0.2	0.3	0.9	4.7	11.0	8.0	7.0
2	22:00 MW		6.6	25.8	9.5	6.5	1.8	0.6	0.3	0.4	0.9	3.1	10.2	8.5	11.
2	23:00 MW		6.5	27.1	9.1	6.2	2.0	0.7	0.4	0.6	0.9	2.8	8.6	8.2	11.0
	0:00 MW		8.4	41.3	11.8	7.2	3.2	0.6	0.8	0.6	1.7	1.6	6.9	8.8	16.4
Average wind power generated	MW		9.8	18.6	12.3	6.2	4.3	3.2	4.8	3.5	12.3	11.1	10.5	10.6	19.9
Peak wind power generated (1 hr)	WWp		54.2	41.3	23.3	13.6	14.6	12.5	21.7	14.1	54.2	39.1	19.2	15.9	30.5
Cell/module temperature															
	1:00 degC			16	18	17	14	11	9	8	8	10	12	14	15
	2:00 degC			16	17	16	13	11	8	7	8	10	11	13	15
	3:00 degC			16	17	16	13	10	8	7	7	9	11	13	14
	4:00 degC			15	17	16	13	10	8	6	7	9	11	13	14
	6:00 degC			22	20	10	13	10	8	6	7	10	16	21	22
	7:00 degC			28	26	21	16	12	9	7	9	13	21	27	29
	8:00 degC			35	32	26	19	14	11	10	11	18	27	32	36
	9:00 degC			41	37	31	23	17	13	12	15	23	33	38	41
1	L0:00 degC			47	42	36	28	21	16	16	19	28	37	42	46
1	11:00 degC			52	46	40	31	23	19	19	22	31	41	45	50
1	12:00 degC			53	40	42	33	25	20	20	23	32	42	40	21
1	4:00 degC			51	46	40	32	23	18	19	22	29	38	43	48
1	15:00 degC			48	42	38	30	21	17	17	20	26	35	39	45
1	L6:00 degC			44	39	34	27	20	16	16	18	23	31	35	41
1	17:00 degC			38	34	30	24	19	15	15	16	20	25	29	36
1	18:00 degC			31	28	24	22	18	15	14	15	17	20	23	30
1	19:00 degC			25	24	23	21	1/	14	13	14	16	18	20	24
2	1:00 degC			25	25	22	20	10	14	13	13	13	17	19	22
2	22:00 degC			20	21	19	10	14	12	11	11	13	14	17	19
2	23:00 degC			18	20	18	16	13	11	10	10	11	13	16	18
	0:00 degC			17	18	17	15	12	10	9	9	11	12	14	16
Ave	erage degC			31	29	26	21	16	13	12	14	18	23	27	30
	Max degC			54	48	42	33	25	20	20	23	32	42	46	51
Gross AC power generated															
	1:00 MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	2:00 MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	3:00 MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	4:00 MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	6:00 MW		0.8	20.3	9.6	1.8	0.0	0.0	0.0	0.0	0.0	1 3	13.9	25.6	26.1
	7:00 MW		18.4	38.5	28.0	13.3	5.5	2.1	1.2	1.6	3.2	9.5	31.1	40.9	46.1
	8:00 MW		30.1	56.0	44.7	28.0	14.1	7.0	5.7	6.0	8.5	23.8	48.7	55.7	63.8
	9:00 MW		41.0	71.2	58.0	42.2	25.7	11.9	9.0	9.8	18.3	38.5	62.6	68.5	77.8
1	0:00 MW		50.8	83.2	70.1	53.9	35.7	20.1	12.4	16.1	28.5	49.4	73.1	79.3	88.2
1	1:00 MW		58.4	94.0	80.4	62.5	41.7	26.1	19.0	23.2	36.2	56.4	80.8	86.0	95.9
1	12:00 MW		60.9	98.5	83.9	64.0	44.5	29.2	23.2	25.5	39.2	58.0	82.2	86.3	97.1
1	4.00 MW		53.0	95.7	83.3 77.3	59.2	45.0	27.8	16.9	25.8	33.6	49.1	70.5	84.4 77.7	93.4
1	15:00 MW		44.1	80.6	66.4	51.6	30.7	14.2	10.3	12.0	25.6	39.4	58.6	63.7	77.0
1	16:00 MW		32.5	65.8	54.6	37.8	19.3	6.8	5.8	5.9	13.2	26.1	43.3	48.4	63.8
1	17:00 MW		18.6	47.3	35.2	20.2	6.3	1.7	1.0	1.3	4.0	10.3	22.6	27.1	46.9
1	18:00 MW		6.5	25.2	12.6	2.8	0.2	0.0	0.0	0.0	0.0	0.6	2.1	6.9	27.0
1	19:00 MW		0.6	2.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.3
2	20:00 MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	2:00 MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	2:00 IVIV		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0:00 MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total solar power generated	MW		20.2	36.2	29.3	20.9	12.9	7.1	5.2	6.1	10.3	17.4	27.9	31.5	37.5
Peak solar power generated (1 br)	MW	98.5	98.5	98.5	83.9	65.1	45.0	29.2	23.2	25.8	39.2	58.0	82.2	86.3	07.1

Figure 11 Southern Goldfields power generation: Kalgoorlie





Notes: Wind speed at anemometer reference height (not turbine hub height). Wind power density at turbine hub height Daily gross power profile is DC power from solar PV.

Figure 13 Southern Goldfields power generation: Forrest

0				0												
	Forrest © K1 Capital Pty Ltd 2021	Units	•	Total	Jan 1	Feb 2	Mar 3	Apr 4	May 5	Jun 6	Jul 7	Aug 8	Sep 9	Oct 10	Nov 11	Dec 12
	• · · · · · · · · · · · · · · · · · · ·															
Wind Po	ower Generated (gross)															
	1:00	MW		6.3	7.4	12.5	0.7	1./	1./	1.8	2.8	2.6	5.4	12.2	18.1	9.4
	3:00			6.1	5.5	7.4	0.0	1.3	1.5	1.5	2.4	2.1	5.9	12.6	19.4	11.7
	4:00	MW		6.5	7.6	5.8	0.0	0.9	1.4	0.9	2.7	2.7	2.8	13.1	28.5	13.3
	5:00	MW		10.4	12.5	11.4	0.0	1.9	2.3	1.0	2.7	3.6	4.1	20.0	43.0	22.1
	6:00	MW		11.7	10.5	10.8	0.0	3.1	2.9	1.0	3.0	4.4	4.6	22.8	52.3	25.9
	7:00	MW		24.1	28.2	43.8	0.3	8.5	7.0	2.8	8.7	17.4	12.8	38.8	83.9	38.9
	8:00	MW		34.7	34.5	67.1	8.3	21.1	11.5	5.4	18.6	37.8	26.2	47.3	99.1	42.5
	9:00	MW		56.7	64.6	98.6	29.6	46.9	22.8	12.0	47.3	99.2	53.1	60.6	98.8	50.5
	10:00	MW		52.9	34.2	90.0	21.5	40.0	21.9	13.9	54.1	99.8	74.8	52.8	98.0	37.4
	11:00	MW		55.4	30.9	85.3	21.9	42.2	25.6	18.6	72.5	100.7	97.0	51.3	87.6	34.1
	12:00	IVIVV NAVA		45.3	19.2	59.8	19.8	24.9	20.6	17.9	57.3	88.5	99.1	53.8	57.2	27.4
	14:00	MM		48.2	46.3	72.5	18.5	24.0	17.3	15.0	52.5	71.5	87.0	57.1	64.8	52.2
	15:00	MW		52.6	71.3	80.9	22.6	28.8	14.1	14.8	48.7	55.9	89.2	48.9	77.0	80.9
	16:00	MW		49.5	96.9	97.3	30.4	15.5	9.8	7.9	18.4	24.9	40.7	82.0	74.4	97.7
	17:00	MW		50.0	97.6	97.7	57.7	13.9	7.7	5.6	9.7	14.0	19.5	97.7	81.9	98.1
	18:00	MW		52.2	98.0	98.1	98.5	9.8	6.9	2.9	3.3	8.4	7.3	99.9	96.4	98.6
	19:00	MW		51.0	98.5	98.6	86.7	12.7	5.7	3.1	3.1	6.2	8.0	100.4	90.8	99.1
	20:00	MW		49.4	99.1	99.1	78.9	12.7	5.4	2.9	2.5	5.2	8.0	95.4	85.0	99.7
	21:00	MW		39.6	92.3	99.6	56.1	13.1	4.4	4.3	3.1	4.7	17.0	53.9	57.1	73.0
	22:00	MW		30.5	75.7	100.1	20.7	8.5	4.3	2.7	2.9	5.3	5.9	50.1	50.1	43.7
	23:00	MW		18.5	37.1	65.9	9.5	4.7	3.1	2.5	3.3	5.0	5.8	31.2	34.2	23.3
Avera	0:00 The wind power generated	MM		11.8	25.3	32.9	2.8	2.6	2.7	1.2	3.0	4.6	2.7	21.8	30.5	13.1
Peak	vind power generated (1 hr)	MWp		100.7	99.1	100.1	98.5	46.9	3.3 25.6	19.0	72.5	100.7	99.2	49.4	99.0	4/.5 99.7
- Cuit II		p		10017	55.1	100.1	50.5	10.5	25.0	15.0	72.0	100.7	55.2	100.1	55.1	55.7
Cell/mo	dule temperature	degC			16	16	16	14	11	0	7	Q	0	11	12	14
	2:00	degC			10	16	10	14	10	0 8	7	0 7	9	10	12	14
	3:00	degC			15	15	16	13	9	7	6	7	8	9	11	13
	4:00	degC			15	15	16	12	9	7	6	6	8	9	11	13
	5:00	degC			17	15	16	12	9	7	5	6	8	10	13	16
	6:00	degC			24	19	18	13	9	7	5	6	10	16	20	23
	7:00	degC			30	24	22	15	11	8	6	8	14	21	26	29
	8:00	degC			37	30	26	19	14	11	9	11	19	28	32	36
	9:00	degC			41	35	31	23	17	14	11	15	24	33	37	41
	10:00	degC			47	41	37	28	22	18	16	20	28	37	41	46
	11:00	degC degC			49	45	40	31	25	20	20	23	31	39	44	48
	13:00	degC			50	40	41	33	20	21	19	24	32	39	44	49
	14:00	degC			48	43	38	30	24	19	18	22	29	37	42	46
	15:00	degC			45	40	35	27	21	18	16	20	26	33	39	42
	16:00	degC			39	35	30	24	20	17	16	18	23	27	33	37
	17:00	degC			31	29	24	22	18	16	15	16	19	20	26	30
	18:00	degC			22	20	20	21	17	15	15	16	18	16	19	22
	19:00	degC			20	19	19	19	16	14	14	15	17	15	18	19
	20:00	degC			18	17	18	18	15	13	13	13	15	14	16	17
	21:00	degC			18	17	17	17	14	12	10	12	13	14	15	1/
	22:00	degC			17	10	17	10	13	10	01	10	13	12	14	10
	0:00	degC			16	16	17	14	11	9	8	9	11	11	12	15
	Average	degC			29	26	24	20	16	13	12	14	18	21	25	28
	Max	degC			51	46	41	33	26	21	20	24	32	40	45	49
Gross AG	C power generated															
	- 1:00	MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	2:00	MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	3:00	MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	4:00	MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	5:00	MW		2.6	6.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	10.3	9.6
	6:00	MW		12.3	31.9	14.2	4.1	2.0	0.0	0.0	0.0	0.7	5.0	22.8	32.6	33.7
	7:00	IVIVV MANA/		25.4	53.7	36.6	19.2	19.6	5.5	3.9	4.2	7.0	1/.1	40.2	53.0	55.9
	8:00	MM		37.2	/1.1	53.8	35.8	18.0	9.8	8.4	8.9	24.4	30.2	55.5	70.2	/2./ 82.8
	10:00	MW		55.0	89.8	78.5	60.8	39.5	25.5	16.9	19.9	33.5	50.5	72.3	84.7	89.7
	11:00	MW		59.5	92.8	85.1	66.9	43.8	30.2	22.0	25.6	38.6	56.2	74.7	87.0	92.0
	12:00	MW		60.2	93.4	83.2	68.5	44.4	30.8	22.7	26.8	39.5	59.3	74.8	87.3	92.3
	13:00	MW		57.9	92.9	80.7	65.6	42.0	27.7	19.6	23.9	36.8	56.7	72.3	86.1	91.2
	14:00	MW		51.7	89.4	75.5	57.2	35.5	20.9	12.9	17.4	30.5	48.9	65.5	80.8	87.1
	15:00	MW		41.6	80.1	63.7	44.8	25.2	11.6	7.6	9.7	20.5	37.4	52.4	69.4	77.6
	16:00	MW		28.8	63.2	49.9	30.5	11.5	5.2	4.0	5.6	8.6	23.2	33.1	50.7	61.1
	17:00	MW		12.7	37.8	31.6	11.0	1.9	0.2	0.0	0.2	1.5	1.7	6.7	22.7	37.4
	18:00	MW		1.5	5.5	3.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	7.2
	19:00	MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	20:00	MM		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	21:00	MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	23:00	MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0:00	MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total s	solar power generated	MW		20.6	37.1	30.2	21.4	12.7	7.7	5.4	6.4	10.6	17.8	26.7	33.9	37.1
Peaks	olar nower generated (1 hr)	MW	93.4	93.4	93.4	85.1	68.5	44.4	30.8	22.7	26.8	39.5	59.3	74.8	87.3	92.3

5. Mid-West location

We based our estimates on BOM and NREL information for Geraldton.



Notes: Wind speed at anemometer reference height (not turbine hub height). Wind power density at turbine hub height. Daily gross power profile is DC power from solar PV.

	JUwei	genera	nuon.	Uerai	uton										
Geraidton © K1 Capital Pty Ltd 2021	Units	÷	Total	Jan 1	Feb 2	Mar 3	Apr 4	May 5	Jun 6	Jul 7	Aug 8	Sep 9	Oct 10	Nov 11	Dec 12
Wind Power Generated (gross)															
1:00	MW		5.7	22.6	4.9	12.1	1.9	0.1	7.9	1.4	3.0	0.0	0.0	1.4	12.1
2:00	MW		5.6	17.6	3.7	11.4	2.1	0.7	9.9	4.5	7.1	0.3	0.0	1.0	7.9
3:00	MW		7.2	21.8	6.2	12.3	3.8	2.1	10.1	10.2	8.5	1.5	0.0	1.6	8.0
4:00			6.5 7 0	13.7	13.4	11.4	3.9 5.8	3.0 5.8	9.9	8.4	12.2	1.0	0.0	1.0	5.
6:00	MW		7.6	7.9	11.6	9.5	5.0	8.5	9.4	14.6	16.6	1.7	0.0	0.9	6.3
7:00	MW		12.4	18.8	30.5	16.0	11.3	13.6	9.2	12.1	14.8	2.6	0.1	4.5	16.0
8:00	MW		19.3	26.6	51.3	23.5	17.7	23.4	11.6	10.8	16.9	8.9	2.0	13.1	27.5
9:00	MW		40.5	60.9	100.7	49.5	44.9	46.4	15.2	8.9	20.7	22.3	8.5	47.1	64.
10:00	MW		38.3	66.9	78.9	50.9	33.2	31.5	20.6	11.5	24.5	19.7	9.6	40.6	73.4
11:00	MW		53.2	99.5	93.1	76.1	45.2	25.2	27.3	13.0	31.4	33.9	26.7	69.7	99.9
12:00			54.3	99.2	82.7	88.4	35.8	15.9	31.3	19.7	32.8	34.3 52.7	37.9	100.2	99.
13:00	MW		68.5	99.1	98.9	99.2	90.2	18.4	34.3	13.5	37.7	49.9	89.6	100.3	99
15:00	MW		70.2	99.2	99.0	99.3	100.1	18.5	27.4	12.8	32.7	54.6	101.3	100.5	99.
16:00	MW		62.9	99.4	99.2	99.5	93.0	7.0	17.5	6.0	14.4	31.6	89.3	100.7	100.
17:00	MW		56.2	99.6	99.4	99.7	79.0	2.2	11.2	1.4	6.3	20.4	57.8	100.9	100.
18:00	MW		51.7	99.9	99.7	100.0	61.6	1.2	5.7	0.3	1.6	9.7	42.8	101.2	100.
19:00	MW		47.4	100.2	100.0	98.6	38.0	0.4	4.6	0.3	1.0	4.0	22.2	101.5	100.
20:00	MW		37.9	100.6	100.3	65.4	21.8	0.0	3.3	0.1	0.3	0.4	7.9	56.4	101.
21:00	IVI VV		25.9	98.6	/3.8	33.6	8.5	0.0	4.3	0.1	0.4	0.3	4.1	24.7	51.0
22:00	MW		10.3	47.2	41.0	19.3	2.8	0.0	4.1	0.1	0.2	0.0	1.4	14.5	31 3
0:00	MW		8.0	30.2	9.4	17.4	2.8	0.2	7.8	0.3	1.6	0.0	0.0	3.9	22.5
Average wind power generated	MW		32.6	63.1	59.2	51.3	33.0	10.2	13.7	7.3	13.9	14.7	23.8	44.5	58.4
Peak wind power generated (1 hr)	MWp		101.5	100.6	100.7	100.0	100.1	46.4	34.3	19.7	37.7	54.6	101.3	101.5	101.3
Cell/module temperature															
1:00	degC			17	19	18	17	16	12	12	12	14	15	16	16
2:00	degC			17	19	17	16	15	12	11	11	13	15	16	16
3:00	degC			16	18	16	16	14	11	10	10	12	14	15	16
4:00	degC			16	1/	16	15	13	11	10	10	12	14	15	16
5:00	degC			10	17	16	15	12	10	9	9	12	14	17	20
7:00	degC			24	20	18	15	12	11	9	10	13	20	23	25
8:00	degC			30	25	23	18	14	13	11	12	17	25	28	31
9:00	degC			35	30	28	22	16	15	14	16	21	29	33	36
10:00	degC			40	37	33	27	21	18	18	20	26	34	38	41
11:00	degC			43	41	37	31	25	21	21	24	30	37	41	44
12:00	degC			45	44	39	33	28	23	23	26	32	38	43	46
13:00	degC			45	44	39	32	28	23	24	27	32	37	41	46
14:00	degC			43	43	38	31	27	23	24	20	30	30	41	44
15:00	degC			37	36	32	25	23	19	20	27	26	29	34	37
17:00	degC			32	32	27	23	22	18	19	20	22	25	29	32
18:00	degC			26	26	22	20	21	18	19	18	18	19	21	25
19:00	degC			20	20	20	20	21	17	18	18	17	17	17	19
20:00	degC			18	19	20	19	20	17	17	17	18	17	17	17
21:00	degC			18	19	20	20	20	16	16	16	17	16	17	17
22:00	degC			18	19	19	19	19	15	16	16	17	16	16	17
23:00	degC			17	20	19	19	18	14	15	15	16	16	17	16
0:00	degC			27	19	24	21	1/	15	14	13	20	23	25	27
Max	degC			45	44	39	33	28	23	24	27	32	38	43	46
Gross AC power generated															
1:00	MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2:00	MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3:00	MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4:00	MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5:00	MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6:00	MW		2.4	7.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	5.4	14.3
7:00			11.7	27.5	12.3	7.5	1.8	0.3	0.0	0.0	0.4	4.7	18.8	30.7	36.7
8:00	MW		25.1	49.1 68.4	53.5	40.5	22.8	10.6	7 9	3.Z 8.4	5.5 16.7	34.2	56.8	69.3	78 1
10:00	MW		51.9	83.4	70.2	56.8	35.4	21.8	13.4	16.0	29.5	47.8	69.6	85.3	94.8
11:00	MW		62.1	95.1	84.0	66.9	45.4	30.8	22.1	25.5	39.1	58.8	80.7	93.3	104.6
12:00	MW		67.7	101.9	89.9	73.7	49.9	35.5	27.1	30.4	43.8	64.6	85.4	99.7	111.5
13:00	MW		69.1	104.1	95.2	75.7	49.3	36.2	27.7	31.6	45.2	65.9	86.5	99.3	113.3
14:00	MW		65.9	101.6	91.7	73.4	46.0	32.5	24.9	28.3	42.4	59.6	82.8	100.1	109.0
15:00	MW		57.8	94.0	82.5	63.5	38.7	25.5	19.1	22.4	35.1	50.8	73.8	89.3	99.
16:00	MW		45.6	81.1	72.5	49.9	27.5	14.6	8.8	12.6	23.9	38.6	58.0	75.9	85.0
17:00			30.6	62.4	56.2	32.1	13.6	4.8	4.1	5.1	9.4	21.5	38.6	56.5	64.
18:00	MW		2.0	0.0	35.7	0.0	2.2	0.4	0.0	0.4	1.7	5.9	9.8	25.9	0.0
20:00	MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
21:00	MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22:00	MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23:00	MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0:00	MW		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total solar power generated	MW		22.7	38.6	32.5	23.9	14.2	9.1	6.6	7.7	12.2	19.5	29.3	36.8	42.3
неак solar power generated (1 hr)	IVI VV	113.2	113.2	104.1	95.2	/5.7	49.9	36.2	21.7	31.6	45.2	65.9	86.5	100.1	113.2

Figure 15 Mid-West power generation: Geraldton

6. Forecast power profiles

Annual average daily average power profiles for all projects are shown below. These profiles assume all power is sold (nil to electrolyzer) for simplicity of presentation.



Nomgon-IX



Port Hedland



Broome



Esperance



Kalgoorlie



Forrest



Geraldton



Notes: all projects assume 100 Ha of solar PV array area and 100 MW nominal wind generation capacity

K1 Capital

Renewable resource comparison

7. Appendices

7.1 Mongolia location map



7.2 Wind speed data for Manlai, Mongolia



Mon Jul 16 15:55:51 2001

Source: D Elliott, M Schwartz, G Scott, S Haymes, D Heimiller, R George, "Wind Energy Resource Atlas of Mongolia", National Renewable Energy Laboratory, 2001. Manlai site summary, Umnugovi province, Mongolia, page 168

7.3 Solar resource data for Mongolia

n.b. provided for illustration, but not used in this analysis (NREL data used instead)

				Ta	ble V.	Nume	rical v	alues c	of all p	aram	cters i	n the	Figure	7-13										
Year						2003									Ċ4	004							2002	р — а
Month	8	4	8	9	2	90	6	10	=	12	-	-	6	4	5	9			6	10	1 12	-	5	1
Average year albedo	0.34	0-33	0.29	0.28	0.28	0.27	0.28	0.32	0.39	045	0.45	0.39	0.34	0-33	3.29	0.28 0	28 0.	27 0	28 0	32 0	39 04	5 04	5 0-39	
Measured albedo	0-28	0-28	0-23	0.28	0-27	0-27	0.28	67-0	0.32	0.32 6	1296 0	302 (1288 0	283	9-27 0	259 0-2	53 0.2	46 0-2	67 0.2	87 0	35 0.25	8 0.28	0-417	
Measured humidity [%]	49.75	33-33	34.62	38.25	42.17	43-11	47-86	38.52	55.91	5343 3	9.38 4	5.98	2.69 2	4.38 2	563 3	2.63 36	64 37.	48 37	36 32	41 45	46 59.5	6 57-1	1 59-85	
Average year sunshine duration [h]	262	258	202	308	302	297	278	258	213	198	210	217	292	258	298	308 3	3	97 2	78 2	58 2	13 15	8 21	217	
Standard deviation [h]	28.4	25.55	23-2	27.3	29-8	25-7	12	20.8	21-2	15.5	27.2	27.2	284	25-5	23-2	21-3 24	18 21	15	22	0-8 21	2 15	5 27	27-2	
Possible sunshine duration [h]	369	403	458	464	470	434	377	340	287	272	284	290	369	403	458	464 4	79	34 3	3 3	40 2	87 27	2 28	1 290	
Average year fraction [h]	0.71	0.64	0-65	0.66	0.64	0.68	0-74	0.76	0.74	0-73	0.74	0.75	0-71	0-64	965	0 99-0	64 0	68 0.	74 0	76 0	74 0.7	3 0.7	1 0.75	
Measured sunshine duration [h]	279.5	269-8	282	283	288.2	277-8	7-592	275	213-2	229 2	35.8 2	1.10	563 2	98-5 3	37-2	281 30	0.3 283	2.5 268	8.7 275	57 236	5.5 202	5 244	3 236	
Measured fraction	0.76	0-67	0.63	0.61	0.61	0.64	0.70	0.81	0-74	0.84	0.83	0-81	0.69	0.74	967	0 19-0	64 0	66 0.	71 0	81 0	82 0.7	4 0.8	5 0.81	
Horizontal irradiation [kW/m ² /d]	3.7	2.7	2.1	2.7	3.6	46	5.7	6.5	9-9	64	0.9	5.0	40	3.6	2.2	2.5	13	18	I	7.2 6	1 13	0 5	9 50	
Average year horizontal irradiation [kW/m2/d]	7	22	1-2	2.0	3-0	44	5.7	6-5	6-5	6.0	Ţ	4.7	ž	22	1-1	2.0	2	1	57	6.5 6	55 6	0 5	4 47	
In-plane irradiation [kW/m ² /d]	5-6	5.2	4.0	4.9	5.8	6.2	6.2	62	6-0	5.8	6.2	6-3	6.5	4-9	49	51	99	05	72	6.9	52 6	9 9	2 62	
Sapporo horizontal irradiation [kW/m2/d]	2.6	1.6	13	15	2.3	3.3	43	48	5.0	46	42	3.5	26	9-1	13	1.5	23	3.3	2	4.8	4	6 4	3.5	
Rated energy output I [Wh/d]	435	429	455	449	434	406	385	454	377	374	375	17	Ŧ	470	161	438 4	8	33	74 4	129 4	21 25	5 38	346	
Rated energy output 2 [Whid]	408	402	426	421	401	381	361	426	354	351	352	407	322	440	460	411 4	8	80 3	61 4	102 3	94 24	98 12	324	
Real energy output 1 [Wh/d]	409	388	16E	377	370	346	338	421	375	381	379	426	328	418	428	366 3	69	52 3	24 3	188 4	22	98	5 349	
Real energy output 2 [Wh/d]	366	345	352	335	328	308	302	377	324	328	326	362	277	352	365	305 3	15 3	03 2	81 3	14 3	60 24	5 33	162 8	
In-plane reference yield [Wd]	631	6-21	6.18	6.02	585	6-18	6.30	6-45	4.88	4.89	5-11	5.65	6-18	7:21	165	5-16 6	9 09	3	23 6	32 5	44 41	1 53	6.00	
Yield of module 1 [h/d]	5.93	5-63	5-39	5.05	4.98	5-27	5.52	5.98	4.86	4.98	5-17	554	5.90	641	502	5.14 5	30 5	13 5.	5 60	63 5	46 4.3	2 53	5 6-07	
Yield of module 2 [h/d]	5-66	5.34	5-10	61-70	472	5-01	5-26	5-71	447	4.58	4.73	5-03	5-32	5-76	532	1.58 4	83 4-	71 4	-98 -5	32 4	8 33	4 49	1 5-51	
Performance ratio of module 1	0.94	16-0	0.80	0.84	0.85	0.85	0.88	0.93	1.00	1-02	10-1	0.98	0.95	0.89	987	9.83 0	80 0	82 0	87 0	-1 06	00 1-0	0 10	101 0	
Temperature factor, Kiempi	1.05	10-1	0.93	0.95	0.93	0.94	96-0	1.01	1.08	1.10	1-10	1-02	1.06	66-0	1 160	0 660	92 0	93 0	1 16	00 1	05 1-0	9 1-0	0 1.09	
Other loss factor, K _{wh1}	060	0.90	0-90	68-0	0.92	160	16-0	0.92	0-92	0.92	0-92	16-0	0.90	060	060	0 68-0	87 0.	88 0.	90	0 06	96 0.5	4 0.9	2 0.93	
Performance ratio of module 2	06-0	0.86	0.83	0.80	0.81	0.81	0.83	0.88	0.92	0.94	0.93	68-0	0.86	0.80	577	0.74 0	73 0	75 0	80 0	85 0	91 0.5	2 0.9	3 0.92	
Temperature factor, K _{tomp2}	1-05	1-01	0-6-0	0.95	0.94	0.95	0-97	101	1-02	1-10	60-1	1-07	1-06	6610	398	0 160	93 0	95 0	1 16	1 10	04 1-0	0 10	8 1-07	
Other loss factor, Kee2	0.86	0-85	0-83	180	0.86	0.85	0.86	0.88	0.86	0.85	0-85	0-83	0-81	0-81	64.0	0 62.0	78 0	80 0	82 0	85 0	88 0.5	6 0.8	5 0.86	
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Figure 9. In-plane and horizontal global irradiation in comparison to data for an average year and for Sapporo

Source: Amarbayar Adiyabat, Kosuke Kurokawa, Kenji Otani, Namjil Enebish, Garmaa Batsukh, Mishiglunden Battushig, Dorjsuren Ochirvaani and Bathuu Ganbat,

"Evaluation of Solar Energy Potential and PV Module Performance in the Gobi Desert of Mongolia", Prog. Photovolt: Res. Appl. 2006; 14:553–567

Site	Γ	Dalanzadga	d		Sainshand	
Compare	Predicted	NASA	NAMEN	Predicted	NASA	NAMEN
Jan	4.92	6.25	4.70	4.85	5.83	4.94
Feb	6.26	7.25	5.88	6.00	6.78	5.90
Mar	6.90	7.58	5.31	7.34	7.63	6.34
Apr	7.76	7.8	5.56	7.75	7.66	5.82
May	9.43	7.44	6.08	8.92	7.49	5.93
Jun	10.06	6.79	5.78	9.51	7.13	5.62
Jul	8.77	6.01	5.23	9.09	6.22	5.57
Aug	8.98	5.78	5.19	8.68	5.68	6.00
Sep	8.30	6.61	5.69	8.22	6.27	6.18
Oct	7.36	6.86	6.35	6.98	6.01	5.99
Nov	6.10	5.8	5.34	5.34	5.62	5.62
Dec	5.10	5.53	4.85	4.29	5.10	4.96
Average, W/m ²	885.0	-	747.5	840.8	-	644.4
Annual, kWh/m ² /a	2737.36	2421.95	1650.67	2647.36	2352.07	1898.13

Table 4 Comparison of assessed DNI data sources (kWh/m²/day)

Source: Tumenjargal Makhbala*, Sukruedee Sukchaib and Prapita Thanarakb,

"Techno-economic assessment of future perspectives of the concentrated solar power plant in Mongolia", International Journal of Renewable Energy, Vol. 7, No. 2, July - December 20122



Source: K1 Capital analysis of various data sources

K1 Capital disclosures

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