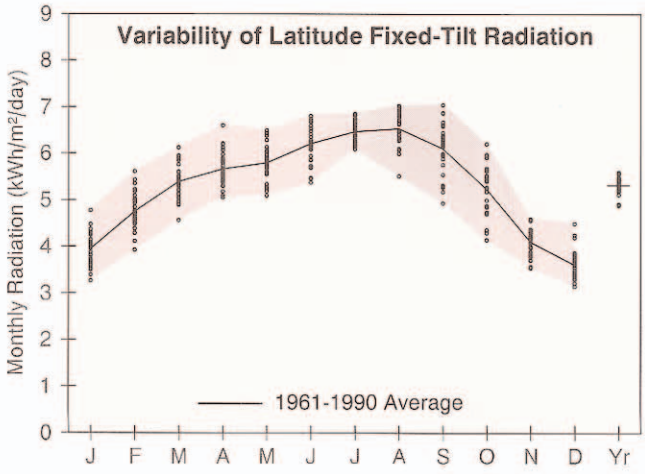
Casper, WY

WBAN NO. 24089

LATITUDE: 42.92° N
LONGITUDE: 106.47° W
ELEVATION: 1612 meters
MEAN PRESSURE: 837 millibars

STATION TYPE: Secondary



Solar Radiation for Flat-Plate Collectors Facing South at a Fixed Tilt (kWh/m²/day), Uncertainty ±9%

Tilt (°)		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
0	Average	2.0	2.9	4.1	5.2	6.1	7.0	7.0	6.3	4.9	3.4	2.2	1.7	4.4
	Min/Max	1.8/2.2	2.6/3.2	3.6/4.5	4.7/5.9	5.4/6.7	6.0/7.6	6.6/7.5	5.4/6.7	4.2/5.6	2.9/3.9	2.0/2.4	1.6/2.0	4.1/4.6
Latitude -15	Average	3.4	4.3	5.2	5.8	6.2	6.8	7.0	6.8	6.0	4.8	3.6	3.1	5.2
	Min/Max	2.9/4.1	3.6/5.0	4.4/5.8	5.2/6.7	5.4/6.9	5.8/7.4	6.6/7.4	5.8/7.3	4.9/6.9	3.9/5.7	3.2/4.0	2.7/3.8	4.8/5.5
Latitude	Average	3.9	4.7	5.4	5.7	5.8	6.2	6.5	6.5	6.1	5.2	4.1	3.6	5.3
	Min/Max	3.3/4.8	3.9/5.6	4.6/6.1	5.1/6.6	5.1/6.5	5.4/6.8	6.1/6.8	5.5/7.0	4.9/7.0	4.1/6.2	3.5/4.6	3.1/4.5	4.9/5.6
Latitude +15	Average	4.3	4.9	5.3	5.3	5.1	5.3	5.6	5.9	5.9	5.3	4.3	3.9	5.1
	Min/Max	3.5/5.2	4.0/5.9	4.5/6.1	4.7/6.1	4.5/5.7	4.6/5.8	5.3/5.9	5.0/6.3	4.7/6.8	4.2/6.3	3.7/4.9	3.4/4.9	4.7/5.4
90	Average	4.1	4.5	4.3	3.6	3.0	2.8	3.0	3.7	4.3	4.5	4.0	3.8	3.8
	Min/Max	3.3/5.0	3.6/5.4	3.6/4.9	3.2/4.1	2.7/3.4	2.6/3.0	2.9/3.2	3.1/3.9	3.4/4.9	3.5/5.3	3.5/4.6	3.3/4.8	3.5/4.0

Solar Radiation for 1-Axis Tracking Flat-Plate Collectors with a North-South Axis (kWh/m²/day), Uncertainty ±9%

Axis Tilt (°)		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
0	Average	3.2	4.4	5.9	7.2	8.2	9.5	9.7	9.0	7.3	5.2	3.5	2.7	6.3
	Min/Max	2.6/3.8	3.6/5.3	4.7/6.8	6.2/8.7	6.9/9.5	7.7/10.7	8.9/10.6	7.4/9.9	5.8/8.6	4.1/6.2	3.0/3.9	2.4/3.4	5.6/6.7
Latitude -15	Average	4.2	5.4	6.7	7.7	8.4	9.6	9.9	9.5	8.1	6.3	4.5	3.8	7.0
	Min/Max	3.5/5.2	4.4/6.6	5.4/7.8	6.6/9.4	7.1/9.7	7.7/10.8	9.1/10.8	7.7/10.5	6.3/9.7	4.9/7.5	3.8/5.1	3.2/4.7	6.2/7.5
Latitude	Average	4.6	5.8	6.9	7.6	8.2	9.2	9.5	9.3	8.2	6.6	4.9	4.2	7.1
	Min/Max	3.8/5.7	4.7/7.0	5.5/8.1	6.5/9.3	6.9/9.5	7.4/10.4	8.7/10.4	7.6/10.3	6.4/9.8	5.1/7.9	4.1/5.5	3.6/5.3	6.3/7.6
Latitude +15	Average	4.9	5.9	6.9	7.3	7.7	8.6	9.0	8.9	8.0	6.6	5.1	4.4	7.0
	Min/Max	4.0/6.0	4.7/7.2	5.4/8.0	6.3/8.9	6.5/8.9	6.9/9.7	8.2/9.8	7.2/9.9	6.2/9.6	5.1/8.0	4.3/5.8	3.8/5.7	6.2/7.4

Solar Radiation for 2-Axis Tracking Flat-Plate Collectors (kWh/m²/day), Uncertainty ±9%

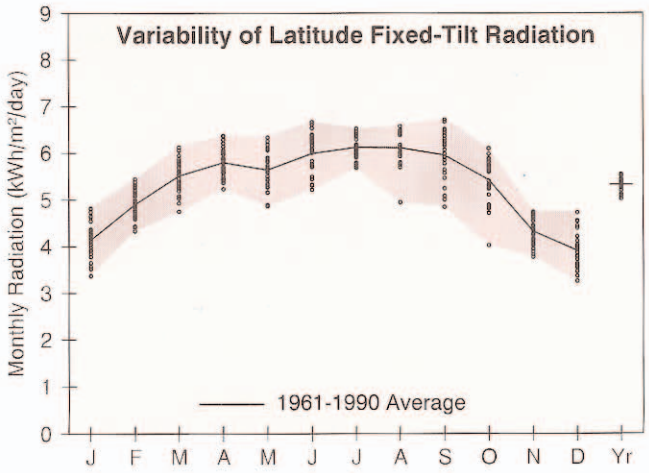
Tracker		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
2-Axis	Average	4.9	5.9	6.9	7.7	8.5	9.8	10.1	9.5	8.2	6.7	5.1	4.5	7.3
	Min/Max	4.0/6.1	4.8/7.2	5.5/8.1	6.6/9.4	7.2/9.9	7.9/11.1	9.2/11.0	7.8/10.6	6.4/9.8	5.2/8.0	4.3/5.8	3.9/5.8	6.5/7.8

Direct Beam Solar Radiation for Concentrating Collectors (kWh/m²/day), Uncertainty ±8%

Tracker		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
1-Axis, E-W Horiz Axis	Average	3.1	3.4	3.5	3.6	4.1	5.2	5.5	5.1	4.5	3.9	3.1	2.9	4.0
	Min/Max	2.2/4.2	2.4/4.5	2.4/4.5	2.7/5.1	2.8/5.1	3.5/6.3	4.7/6.3	3.6/5.9	3.1/5.8	2.6/5.1	2.3/3.7	2.2/4.1	3.3/4.4
1-Axis, N-S Horiz Axis	Average	2.1	3.0	3.9	4.7	5.5	6.9	7.3	6.8	5.5	3.8	2.3	1.9	4.5
	Min/Max	1.5/2.9	2.1/4.0	2.6/5.1	3.4/6.6	3.8/6.9	4.6/8.4	6.2/8.4	4.9/8.0	3.7/7.1	2.5/4.9	1.7/2.8	1.4/2.7	3.6/5.0
1-Axis, N-S Tilt=Latitude	Average	3.3	4.1	4.7	5.1	5.4	6.6	7.0	7.0	6.3	5.0	3.5	3.1	5.1
	Min/Max	2.4/4.6	2.9/5.5	3.2/6.1	3.7/7.1	3.8/6.8	4.4/8.0	6.0/8.1	5.0/8.2	4.2/8.1	3.3/6.4	2.6/4.2	2.3/4.4	4.1/5.7
2-Axis	Average	3.6	4.2	4.8	5.2	5.8	7.1	7.5	7.2	6.3	5.0	3.7	3.3	5.3
	Min/Max	2.6/4.9	3.0/5.6	3.2/6.1	3.8/7.2	4.0/7.2	4.8/8.6	6.4/8.7	5.2/8.4	4.3/8.1	3.4/6.5	2.7/4.4	2.5/4.8	4.3/5.9

Average Climatic Conditions

Element	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
Temperature (°C)	-5.3	-3.1	0.8	6.0	11.3	17.1	21.6	20.4	14.3	8.0	0.6	-4.6	7.3
Daily Minimum Temp	-11.1	-8.9	-5.7	-1.4	3.3	8.3	12.2	11.0	5.3	0.1	-5.7	-10.2	-0.2
Daily Maximum Temp	0.4	2.8	7.3	13.4	19.2	25.9	30.9	29.8	23.2	15.8	6.8	1.1	14.7
Record Minimum Temp	-40.0	-33.9	-29.4	-20.0	-8.9	-2.2	-1.1	0.6	-8.9	-19.4	-29.4	-40.6	-40.6
Record Maximum Temp	15.6	20.0	23.3	28.3	33.3	38.9	40.0	38.9	35.6	29.4	21.7	16.1	40.0
HDD, Base 18.3°C	734	599	543	370	219	77	6	20	139	321	532	709	4268
CDD, Base 18.3°C	0	0	0	0	0	39	106	84	19	0	0	0	247
Relative Humidity (%)	64	65	62	58	57	51	44	43	49	54	61	64	56
Wind Speed (m/s)	7.6	6.8	6.2	5.6	5.2	4.8	4.6	4.6	4.9	5.4	6.4	6.9	5.7



Cheyenne, WY

WBAN NO. 24018

LATITUDE: 41.15° N
LONGITUDE: 104.82° W
ELEVATION: 1872 meters
MEAN PRESSURE: 811 millibars

STATION TYPE: Secondary

Solar Radiation for Flat-Plate Collectors Facing South at a Fixed Tilt (kWh/m²/day), Uncertainty ±9%

Tilt (°)		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
0	Average	2.2	3.1	4.2	5.3	6.0	6.7	6.7	5.9	4.9	3.6	2.4	1.9	4.4
	Min/Max	1.9/2.4	2.8/3.3	3.8/4.6	4.9/5.8	5.2/6.6	5.9/7.5	6.2/7.1	4.9/6.4	4.2/5.4	3.0/4.0	2.2/2.6	1.7/2.2	4.2/4.6
Latitude -15	Average	3.6	4.4	5.3	5.9	6.0	6.5	6.6	6.3	5.8	5.0	3.8	3.3	5.2
	Min/Max	3.0/4.1	3.9/4.9	4.6/5.8	5.3/6.5	5.2/6.7	5.7/7.3	6.1/7.1	5.1/6.8	4.8/6.6	3.8/5.6	3.3/4.2	2.8/4.0	4.9/5.4
Latitude	Average	4.1	4.9	5.5	5.8	5.6	6.0	6.1	6.1	6.0	5.4	4.3	3.9	5.3
	Min/Max	3.4/4.8	4.3/5.4	4.8/6.1	5.2/6.4	4.9/6.3	5.2/6.7	5.7/6.5	4.9/6.6	4.8/6.7	4.0/6.1	3.8/4.7	3.3/4.7	5.0/5.5
Latitude +15	Average	4.5	5.1	5.5	5.4	5.0	5.1	5.3	5.5	5.7	5.5	4.6	4.2	5.1
	Min/Max	3.6/5.2	4.5/5.7	4.7/6.1	4.9/5.9	4.3/5.6	4.5/5.7	4.9/5.6	4.5/5.9	4.6/6.5	4.0/6.2	4.0/5.0	3.5/5.2	4.8/5.3
90	Average	4.2	4.5	4.3	3.6	2.8	2.6	2.8	3.3	4.1	4.6	4.2	4.1	3.8
	Min/Max	3.3/4.9	4.0/5.2	3.7/4.9	3.3/4.1	2.5/3.1	2.4/2.8	2.6/2.9	2.8/3.5	3.2/4.6	3.3/5.2	3.7/4.7	3.4/5.1	3.5/3.9

Solar Radiation for 1-Axis Tracking Flat-Plate Collectors with a North-South Axis (kWh/m²/day), Uncertainty ±9%

Axis Tilt (°)		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
0	Average	3.4	4.6	6.1	7.4	8.0	9.0	9.1	8.3	7.1	5.5	3.7	3.1	6.3
	Min/Max	2.8/4.0	4.1/5.2	5.1/7.0	6.6/8.3	6.6/9.1	7.5/10.5	8.4/9.9	6.3/9.2	5.6/8.2	4.1/6.3	3.3/4.1	2.5/3.7	5.8/6.7
Latitude -15	Average	4.5	5.7	6.9	7.9	8.1	9.0	9.2	8.7	7.8	6.6	4.8	4.1	6.9
	Min/Max	3.6/5.2	4.9/6.3	5.7/7.9	7.0/8.9	6.6/9.3	7.5/10.6	8.5/10.0	6.6/9.7	6.1/9.1	4.7/7.4	4.1/5.3	3.3/5.0	6.4/7.4
Latitude	Average	4.9	6.0	7.1	7.8	7.9	8.7	8.9	8.6	7.9	6.9	5.2	4.6	7.0
	Min/Max	3.9/5.8	5.2/6.8	5.8/8.1	6.9/8.8	6.4/9.0	7.2/10.1	8.2/9.7	6.4/9.5	6.2/9.2	4.9/7.8	4.5/5.7	3.7/5.6	6.5/7.5
Latitude +15	Average	5.2	6.2	7.0	7.5	7.4	8.1	8.3	8.2	7.7	6.9	5.4	4.9	6.9
	Min/Max	4.1/6.1	5.4/6.9	5.8/8.1	6.7/8.5	6.1/8.5	6.7/9.5	7.7/9.1	6.1/9.1	6.0/9.0	4.9/7.9	4.6/6.0	3.9/6.0	6.4/7.3

Solar Radiation for 2-Axis Tracking Flat-Plate Collectors (kWh/m²/day), Uncertainty ±9%

Tracker		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
2-Axis	Average	5.2	6.2	7.1	7.9	8.2	9.3	9.3	8.8	7.9	6.9	5.4	4.9	7.3
	Min/Max	4.2/6.2	5.4/6.9	5.8/8.1	7.0/8.9	6.7/9.4	7.7/10.8	8.7/10.2	6.6/9.7	6.2/9.2	4.9/7.9	4.7/6.0	4.0/6.1	6.7/7.7

Direct Beam Solar Radiation for Concentrating Collectors (kWh/m²/day), Uncertainty ±8%

Tracker		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
1-Axis, E-W Horiz Axis	Average	3.3	3.6	3.6	3.8	3.9	4.8	4.9	4.5	4.3	4.1	3.3	3.2	3.9
	Min/Max	2.3/4.3	2.8/4.3	2.5/4.5	3.0/4.6	2.6/4.8	3.4/6.1	4.3/5.7	2.9/5.2	2.9/5.3	2.4/4.9	2.6/3.9	2.3/4.3	3.5/4.3
1-Axis, N-S Horiz Axis	Average	2.3	3.2	4.1	5.0	5.2	6.4	6.5	6.0	5.2	4.1	2.6	2.1	4.4
	Min/Max	1.7/3.1	2.5/3.9	2.7/5.3	4.0/6.1	3.5/6.5	4.5/8.2	5.7/7.6	3.8/7.0	3.5/6.6	2.4/4.9	2.0/3.1	1.5/2.9	3.9/4.9
1-Axis, N-S Tilt=Latitude	Average	3.6	4.4	4.8	5.3	5.1	6.0	6.2	6.1	5.9	5.2	3.8	3.4	5.0
	Min/Max	2.6/4.7	3.4/5.3	3.2/6.2	4.2/6.5	3.5/6.3	4.3/7.8	5.5/7.3	3.9/7.1	4.0/7.4	3.1/6.3	3.0/4.5	2.4/4.6	4.4/5.5
2-Axis	Average	3.9	4.5	4.9	5.4	5.4	6.6	6.7	6.3	6.0	5.3	4.0	3.7	5.2
	Min/Max	2.7/5.1	3.5/5.4	3.2/6.2	4.3/6.6	3.7/6.7	4.6/8.4	5.9/7.8	4.1/7.4	4.0/7.4	3.1/6.3	3.2/4.7	2.6/5.0	4.6/5.7

Average Climatic Conditions

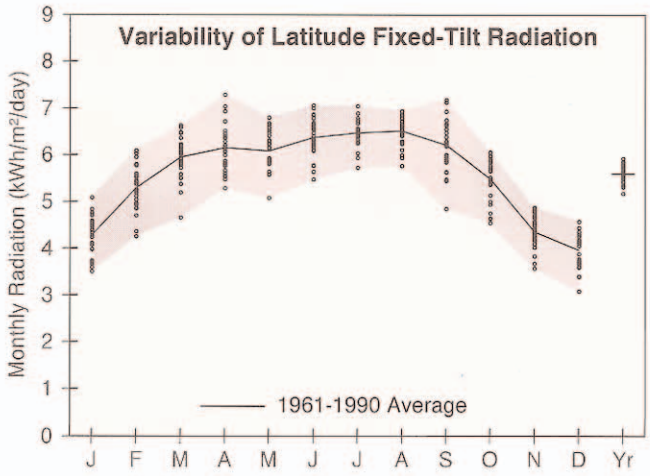
Element	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
Temperature (°C)	-3.1	-1.5	0.9	5.8	11.1	16.3	20.2	19.1	14.1	8.3	1.8	-2.3	7.6
Daily Minimum Temp	-9.3	-7.7	-5.5	-1.1	4.1	9.1	12.6	11.6	6.5	1.1	-4.6	-8.5	0.7
Daily Maximum Temp	3.2	4.7	7.2	12.6	18.1	23.6	27.9	26.7	21.7	15.6	8.2	3.8	14.4
Record Minimum Temp	-33.9	-36.7	-29.4	-22.2	-8.9	-3.9	3.3	2.2	-13.3	-18.3	-25.6	-33.3	-36.7
Record Maximum Temp	18.9	21.7	23.3	27.8	32.2	37.8	37.8	35.6	33.9	28.3	22.8	20.6	37.8
HDD, Base 18.3°C	663	556	541	375	224	83	17	24	139	310	497	641	4070
CDD, Base 18.3°C	0	0	0	0	0	22	76	48	13	0	0	0	158
Relative Humidity (%)	53	55	56	54	56	53	51	51	52	50	54	54	53
Wind Speed (m/s)	7.1	6.6	6.5	6.5	5.8	5.1	4.6	4.6	5.0	5.4	5.9	6.5	5.8

Lander, WY

WBAN NO. 24021

LATITUDE: 42.82° N
LONGITUDE: 108.73° W
ELEVATION: 1696 meters
MEAN PRESSURE: 829 millibars

STATION TYPE: Primary



Solar Radiation for Flat-Plate Collectors Facing South at a Fixed Tilt (kWh/m²/day), Uncertainty ±9%

Tilt (°)		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
0	Average	2.2	3.2	4.4	5.6	6.4	7.1	7.0	6.3	5.0	3.6	2.3	1.9	4.6
	Min/Max	1.9/2.4	2.7/3.6	3.7/4.8	4.9/6.5	5.3/7.1	6.1/7.9	6.2/7.6	5.6/6.7	4.2/5.7	3.1/3.9	2.1/2.6	1.7/2.0	4.3/4.8
Latitude -15	Average	3.7	4.8	5.7	6.2	6.5	7.0	7.0	6.8	6.1	5.1	3.8	3.4	5.5
	Min/Max	3.0/4.3	3.9/5.4	4.5/6.3	5.4/7.4	5.4/7.2	6.0/7.7	6.2/7.6	6.0/7.2	4.8/7.0	4.2/5.6	3.2/4.3	2.7/3.9	5.1/5.8
Latitude	Average	4.3	5.3	6.0	6.1	6.1	6.4	6.5	6.5	6.2	5.5	4.3	4.0	5.6
	Min/Max	3.5/5.1	4.3/6.1	4.7/6.6	5.3/7.3	5.1/6.8	5.5/7.1	5.7/7.0	5.8/6.9	4.8/7.2	4.5/6.1	3.6/4.9	3.1/4.6	5.2/5.9
Latitude +15	Average	4.6	5.6	5.9	5.7	5.4	5.5	5.6	5.9	6.0	5.6	4.6	4.3	5.4
	Min/Max	3.8/5.5	4.4/6.4	4.6/6.7	4.9/6.8	4.5/6.0	4.7/6.0	5.0/6.1	5.2/6.3	4.6/6.9	4.6/6.2	3.8/5.2	3.3/5.0	5.0/5.7
90	Average	4.5	5.1	4.8	4.0	3.2	2.9	3.1	3.6	4.3	4.7	4.3	4.3	4.1
	Min/Max	3.7/5.4	3.8/6.0	3.7/5.8	3.3/5.0	2.7/3.5	2.7/3.1	2.8/3.3	3.3/3.8	3.3/5.0	3.8/5.2	3.5/5.1	3.3/4.9	3.7/4.3

Solar Radiation for 1-Axis Tracking Flat-Plate Collectors with a North-South Axis (kWh/m²/day), Uncertainty ±9%

Axis Tilt (°)		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
0	Average	3.4	4.9	6.5	7.7	8.5	9.8	9.8	9.0	7.4	5.5	3.7	3.0	6.6
	Min/Max	2.6/4.1	3.8/5.6	4.7/7.3	6.5/9.3	6.6/9.9	7.9/11.1	7.5/10.8	7.7/9.7	5.7/8.8	4.5/6.1	3.0/4.1	2.5/3.5	5.9/7.0
Latitude -15	Average	4.6	6.1	7.4	8.3	8.7	9.8	9.9	9.4	8.2	6.6	4.8	4.1	7.3
	Min/Max	3.5/5.5	4.7/7.1	5.4/8.5	6.9/10.0	6.7/10.2	7.9/11.2	7.6/10.9	8.1/10.3	6.2/9.9	5.4/7.4	3.8/5.4	3.2/4.8	6.5/7.8
Latitude	Average	5.0	6.5	7.6	8.3	8.5	9.4	9.5	9.3	8.3	6.9	5.2	4.6	7.4
	Min/Max	3.9/6.1	5.0/7.6	5.5/8.7	6.8/10.0	6.5/9.9	7.6/10.8	7.3/10.6	7.9/10.1	6.2/10.0	5.7/7.8	4.2/5.8	3.5/5.4	6.6/7.9
Latitude +15	Average	5.3	6.7	7.6	8.0	8.0	8.8	9.0	8.8	8.1	7.0	5.4	4.9	7.3
	Min/Max	4.2/6.5	5.1/7.8	5.4/8.7	6.5/9.6	6.1/9.4	7.1/10.1	6.8/9.9	7.6/9.6	6.0/9.8	5.7/7.9	4.3/6.1	3.7/5.7	6.5/7.8

Solar Radiation for 2-Axis Tracking Flat-Plate Collectors (kWh/m²/day), Uncertainty ±9%

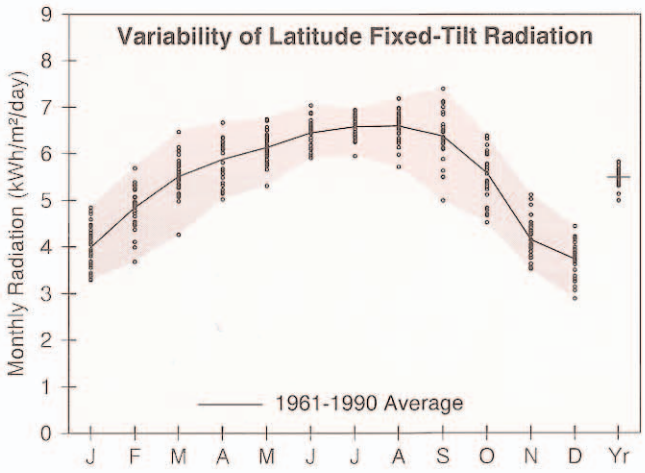
Tracker		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
2-Axis	Average	5.4	6.7	7.7	8.3	8.9	10.0	10.1	9.5	8.4	7.0	5.4	5.0	7.7
	Min/Max	4.2/6.6	5.2/7.8	5.5/8.7	6.9/10.0	6.8/10.3	8.1/11.5	7.8/11.1	8.1/10.3	6.2/10.0	5.7/7.9	4.3/6.2	3.8/5.8	6.8/8.2

Direct Beam Solar Radiation for Concentrating Collectors (kWh/m²/day), Uncertainty ±8%

Tracker		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
1-Axis, E-W Horiz Axis	Average	3.2	3.7	3.9	3.9	4.2	5.2	5.3	5.0	4.5	4.1	3.3	3.2	4.1
	Min/Max	2.3/4.4	2.6/4.8	2.4/4.8	2.7/5.3	2.7/5.4	3.5/6.5	3.7/6.1	3.8/5.5	2.9/5.8	2.9/5.3	2.4/4.0	1.8/4.0	3.5/4.6
1-Axis, N-S Horiz Axis	Average	2.2	3.2	4.3	5.0	5.6	7.0	7.1	6.6	5.5	4.0	2.5	2.0	4.6
	Min/Max	1.5/3.1	2.1/4.2	2.5/5.4	3.5/6.9	3.5/7.3	4.7/8.7	4.6/8.2	4.9/7.5	3.5/7.2	2.8/5.2	1.8/3.0	1.1/2.6	3.8/5.1
1-Axis, N-S Tilt=Latitude	Average	3.5	4.5	5.3	5.4	5.6	6.6	6.9	6.9	6.3	5.2	3.7	3.3	5.3
	Min/Max	2.4/4.8	3.0/5.8	3.0/6.5	3.8/7.4	3.5/7.2	4.4/8.2	4.4/7.9	5.1/7.7	4.0/8.1	3.7/6.7	2.7/4.5	1.8/4.2	4.4/5.8
2-Axis	Average	3.8	4.6	5.3	5.5	5.9	7.2	7.4	7.1	6.3	5.3	3.9	3.6	5.5
	Min/Max	2.6/5.2	3.1/6.0	3.0/6.6	3.8/7.6	3.7/7.6	4.8/8.9	4.8/8.5	5.3/7.9	4.0/8.2	3.7/6.8	2.8/4.8	2.0/4.6	4.5/6.1

Average Climatic Conditions

Element	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
Temperature (°C)	-6.9	-3.7	1.1	6.3	11.7	17.3	21.7	20.5	14.6	8.2	-0.4	-6.2	7.0
Daily Minimum Temp	-13.4	-10.2	-5.5	-0.7	4.4	9.3	13.3	12.1	6.8	0.9	-6.7	-12.6	-0.2
Daily Maximum Temp	-0.4	2.8	7.6	13.2	18.9	25.2	30.1	28.8	22.4	15.4	5.8	0.1	14.2
Record Minimum Temp	-38.3	-33.3	-26.7	-18.9	-7.8	-3.9	3.9	1.7	-12.2	-19.4	-27.8	-38.3	-38.3
Record Maximum Temp	17.2	20.0	24.4	27.8	32.8	37.8	38.3	38.3	34.4	29.4	21.1	17.8	38.3
HDD, Base 18.3°C	784	616	536	362	209	76	5	21	137	313	563	761	4383
CDD, Base 18.3°C	0	0	0	0	0	44	108	88	25	0	0	0	266
Relative Humidity (%)	64	62	56	52	50	45	40	40	46	52	62	65	53
Wind Speed (m/s)	2.4	2.5	3.1	3.5	3.6	3.4	3.4	3.3	3.1	2.7	2.5	2.5	3.0



Rock Springs, WY

WBAN NO. 24027

LATITUDE: 41.60° N
LONGITUDE: 109.07° W
ELEVATION: 2056 meters
MEAN PRESSURE: 794 millibars

STATION TYPE: Secondary

Solar Radiation for Flat-Plate Collectors Facing South at a Fixed Tilt (kWh/m²/day), Uncertainty ±9%

Tilt (°)		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
0	Average	2.1	3.0	4.2	5.4	6.4	7.2	7.2	6.4	5.2	3.7	2.3	1.9	4.6
	Min/Max	1.9/2.4	2.5/3.4	3.5/4.7	4.8/6.0	5.6/7.1	6.6/7.9	6.5/7.6	5.6/6.9	4.3/5.9	3.2/4.1	2.1/2.7	1.7/2.1	4.3/4.8
Latitude -15	Average	3.5	4.4	5.3	6.0	6.5	7.0	7.1	6.9	6.3	5.2	3.7	3.2	5.4
	Min/Max	2.9/4.1	3.4/5.1	4.2/6.1	5.2/6.8	5.7/7.2	6.4/7.7	6.4/7.5	5.9/7.5	5.0/7.2	4.2/5.9	3.2/4.4	2.6/3.8	5.0/5.7
Latitude	Average	4.0	4.8	5.5	5.9	6.1	6.4	6.6	6.6	6.4	5.6	4.1	3.7	5.5
	Min/Max	3.3/4.8	3.7/5.7	4.3/6.5	5.0/6.7	5.3/6.7	5.9/7.0	5.9/6.9	5.7/7.2	5.0/7.4	4.5/6.4	3.5/5.1	2.9/4.4	5.0/5.8
Latitude +15	Average	4.3	5.1	5.5	5.5	5.4	5.5	5.7	6.0	6.1	5.7	4.4	4.1	5.3
	Min/Max	3.5/5.3	3.7/6.0	4.1/6.5	4.6/6.2	4.7/5.9	5.1/6.0	5.2/6.0	5.2/6.5	4.8/7.1	4.6/6.5	3.7/5.4	3.1/4.8	4.8/5.6
90	Average	4.2	4.6	4.3	3.6	3.1	2.8	3.0	3.6	4.4	4.7	4.0	3.9	3.8
	Min/Max	3.3/5.1	3.2/5.6	3.1/5.6	3.1/4.0	2.7/3.3	2.7/3.0	2.8/3.1	3.2/3.9	3.4/5.1	3.8/5.4	3.4/5.0	3.0/4.6	3.4/4.2

Solar Radiation for 1-Axis Tracking Flat-Plate Collectors with a North-South Axis (kWh/m²/day), Uncertainty ±9%

Axis Tilt (°)		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
0	Average	3.3	4.6	6.1	7.5	8.8	10.0	10.0	9.1	7.7	5.7	3.6	2.9	6.6
	Min/Max	2.7/4.0	3.6/5.4	4.4/7.3	6.2/8.7	7.2/10.1	8.6/11.3	8.8/10.9	7.5/10.2	5.7/9.2	4.5/6.7	3.0/4.4	2.3/3.5	5.8/7.0
Latitude -15	Average	4.3	5.6	6.9	8.0	9.0	10.0	10.1	9.6	8.5	6.8	4.6	3.9	7.3
	Min/Max	3.5/5.3	4.2/6.6	5.0/8.3	6.6/9.4	7.3/10.3	8.6/11.4	8.9/11.1	7.8/10.7	6.3/10.2	5.3/8.0	3.8/5.7	2.9/4.7	6.4/7.7
Latitude	Average	4.7	6.0	7.1	8.0	8.7	9.6	9.8	9.4	8.6	7.1	4.9	4.4	7.4
	Min/Max	3.8/5.9	4.4/7.1	5.1/8.6	6.5/9.3	7.1/10.0	8.3/10.9	8.6/10.7	7.7/10.6	6.3/10.4	5.5/8.4	4.1/6.2	3.2/5.2	6.4/7.9
Latitude +15	Average	5.0	6.1	7.0	7.7	8.2	9.0	9.2	9.0	8.5	7.2	5.1	4.6	7.2
	Min/Max	4.0/6.2	4.5/7.3	4.9/8.6	6.2/9.0	6.7/9.5	7.8/10.3	8.1/10.1	7.3/10.1	6.1/10.2	5.5/8.4	4.2/6.5	3.4/5.6	6.3/7.8

Solar Radiation for 2-Axis Tracking Flat-Plate Collectors (kWh/m²/day), Uncertainty ±9%

Tracker		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
2-Axis	Average	5.0	6.1	7.1	8.1	9.1	10.3	10.3	9.6	8.7	7.2	5.2	4.7	7.6
	Min/Max	4.0/6.3	4.5/7.3	5.1/8.6	6.6/9.4	7.4/10.4	8.8/11.7	9.1/11.3	7.8/10.8	6.3/10.4	5.5/8.5	4.3/6.5	3.4/5.7	6.6/8.1

Direct Beam Solar Radiation for Concentrating Collectors (kWh/m²/day), Uncertainty ±8%

Tracker		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
1-Axis, E-W Horiz Axis	Average	3.0	3.4	3.6	3.8	4.4	5.3	5.4	5.0	4.7	4.2	3.1	2.9	4.1
	Min/Max	2.1/4.2	2.2/4.3	2.1/4.4	2.7/4.9	3.0/5.6	4.0/6.6	4.5/6.3	3.6/6.0	2.9/6.1	2.8/5.3	2.2/4.3	1.5/3.9	3.2/4.5
1-Axis, N-S Horiz Axis	Average	2.1	3.0	4.0	5.0	5.9	7.2	7.3	6.7	5.8	4.2	2.4	1.9	4.6
	Min/Max	1.5/3.0	2.1/3.9	2.2/5.1	3.4/6.4	4.0/7.6	5.3/8.9	6.0/8.6	4.7/8.2	3.5/7.7	2.8/5.5	1.7/3.3	0.9/2.6	3.6/5.2
1-Axis, N-S Tilt=Latitude	Average	3.3	4.1	4.8	5.3	5.8	6.8	7.0	6.9	6.6	5.4	3.5	3.1	5.2
	Min/Max	2.3/4.6	2.8/5.3	2.7/6.1	3.7/6.8	4.0/7.5	5.0/8.4	5.8/8.3	4.8/8.4	3.9/8.7	3.6/7.0	2.5/4.9	1.5/4.2	4.1/5.8
2-Axis	Average	3.5	4.2	4.8	5.4	6.1	7.4	7.5	7.1	6.6	5.5	3.7	3.3	5.4
	Min/Max	2.5/4.9	2.8/5.4	2.7/6.1	3.7/6.9	4.2/7.9	5.4/9.2	6.2/8.9	5.0/8.6	3.9/8.7	3.6/7.0	2.6/5.2	1.7/4.6	4.2/6.0

Average Climatic Conditions

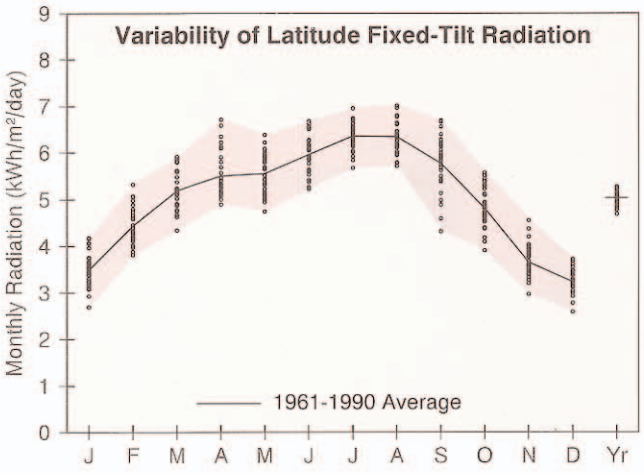
Element	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
Temperature (°C)	-6.4	-4.3	-0.4	4.8	10.2	15.7	20.0	18.8	13.1	6.8	-0.9	-5.9	5.9
Daily Minimum Temp	-11.6	-9.8	-6.3	-2.0	2.7	7.6	11.6	10.4	5.0	-0.4	-6.7	-11.2	-0.9
Daily Maximum Temp	-1.4	1.3	5.4	11.5	17.6	23.7	28.4	27.1	21.1	14.0	4.8	-0.7	12.7
Record Minimum Temp	-37.2	-32.8	-23.9	-13.3	-8.9	-1.7	2.2	0.6	-14.4	-14.4	-24.4	-33.9	-37.2
Record Maximum Temp	12.2	13.3	34.4	25.0	28.9	33.9	34.4	33.3	31.1	25.0	17.8	13.9	34.4
HDD, Base 18.3°C	768	633	581	407	253	103	12	37	168	357	577	751	4647
CDD, Base 18.3°C	0	0	0	0	0	23	64	51	10	0	0	0	148
Relative Humidity (%)	72	70	65	56	50	43	38	39	45	54	69	73	56
Wind Speed (m/s)	5.3	5.3	5.4	5.4	5.0	4.6	4.2	4.1	4.3	4.4	4.7	5.1	4.8

Sheridan, WY

WBAN NO. 24029

LATITUDE: 44.77° N
LONGITUDE: 106.97° W
ELEVATION: 1209 meters
MEAN PRESSURE: 878 millibars

STATION TYPE: Secondary



Solar Radiation for Flat-Plate Collectors Facing South at a Fixed Tilt (kWh/m²/day), Uncertainty ±9%

Tilt (°)		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
0	Average	1.8	2.7	3.9	5.0	5.8	6.7	6.9	6.0	4.6	3.1	2.0	1.6	4.2
	Min/Max	1.6/2.1	2.4/3.1	3.4/4.3	4.6/5.9	5.0/6.6	5.8/7.4	6.1/7.5	5.5/6.6	3.7/5.2	2.7/3.4	1.8/2.3	1.4/1.7	3.9/4.4
Latitude -15	Average	3.1	4.0	5.0	5.6	5.9	6.5	6.9	6.6	5.7	4.5	3.2	2.8	5.0
	Min/Max	2.4/3.6	3.5/4.8	4.2/5.6	5.0/6.8	5.1/6.8	5.7/7.3	6.1/7.5	6.0/7.3	4.3/6.6	3.7/5.2	2.7/4.0	2.3/3.2	4.7/5.2
Latitude	Average	3.5	4.4	5.2	5.5	5.6	6.0	6.4	6.3	5.8	4.8	3.6	3.2	5.0
	Min/Max	2.7/4.2	3.8/5.3	4.3/5.9	4.9/6.7	4.7/6.4	5.2/6.7	5.7/6.9	5.7/7.0	4.3/6.7	3.9/5.6	3.0/4.6	2.6/3.7	4.7/5.3
Latitude +15	Average	3.7	4.6	5.1	5.1	4.9	5.1	5.5	5.7	5.5	4.9	3.8	3.5	4.8
	Min/Max	2.8/4.5	3.9/5.6	4.2/5.9	4.5/6.2	4.2/5.6	4.5/5.7	4.9/6.0	5.2/6.3	4.1/6.4	3.9/5.7	3.1/4.9	2.8/4.1	4.5/5.1
90	Average	3.6	4.2	4.2	3.6	3.0	2.9	3.2	3.7	4.1	4.1	3.6	3.4	3.6
	Min/Max	2.7/4.4	3.4/5.1	3.4/5.0	3.2/4.3	2.7/3.4	2.6/3.1	2.9/3.4	3.3/4.0	3.0/4.8	3.3/4.8	2.8/4.8	2.7/4.0	3.4/3.9

Solar Radiation for 1-Axis Tracking Flat-Plate Collectors with a North-South Axis (kWh/m²/day), Uncertainty ±9%

Axis Tilt (°)		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
0	Average	2.7	4.0	5.5	6.9	7.8	9.1	9.6	8.7	6.8	4.7	3.0	2.4	5.9
	Min/Max	2.2/3.3	3.4/4.8	4.3/6.4	6.0/8.8	6.4/9.1	7.5/10.4	8.1/10.7	7.6/9.9	4.9/8.1	3.8/5.5	2.5/3.8	1.9/2.7	5.4/6.4
Latitude -15	Average	3.7	5.0	6.4	7.4	8.0	9.1	9.8	9.2	7.6	5.7	3.9	3.3	6.6
	Min/Max	2.8/4.4	4.2/6.1	5.0/7.5	6.4/9.6	6.5/9.4	7.5/10.5	8.3/10.9	8.0/10.5	5.4/9.2	4.5/6.8	3.1/5.0	2.6/3.9	6.0/7.0
Latitude	Average	4.0	5.3	6.5	7.4	7.8	8.8	9.5	9.0	7.7	6.0	4.3	3.7	6.7
	Min/Max	3.0/4.9	4.4/6.5	5.1/7.7	6.3/9.5	6.3/9.2	7.2/10.1	8.0/10.6	7.9/10.4	5.4/9.3	4.7/7.1	3.4/5.5	2.8/4.3	6.0/7.1
Latitude +15	Average	4.2	5.4	6.5	7.1	7.3	8.2	8.9	8.6	7.5	6.0	4.4	3.9	6.5
	Min/Max	3.1/5.2	4.5/6.7	5.0/7.7	6.0/9.2	5.9/8.7	6.7/9.5	7.5/10.0	7.5/9.9	5.3/9.1	4.7/7.2	3.5/5.7	3.0/4.6	5.9/6.9

Solar Radiation for 2-Axis Tracking Flat-Plate Collectors (kWh/m²/day), Uncertainty ±9%

Tracker		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
2-Axis	Average	4.3	5.4	6.5	7.5	8.1	9.4	10.0	9.2	7.7	6.0	4.4	4.0	6.9
	Min/Max	3.2/5.2	4.5/6.7	5.1/7.7	6.4/9.6	6.6/9.6	7.7/10.8	8.4/11.2	8.1/10.6	5.5/9.3	4.7/7.2	3.5/5.8	3.0/4.7	6.2/7.3

Direct Beam Solar Radiation for Concentrating Collectors (kWh/m²/day), Uncertainty ±8%

Tracker		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
1-Axis, E-W Horiz Axis	Average	2.3	2.7	3.1	3.4	3.7	4.7	5.3	4.8	4.1	3.4	2.5	2.3	3.5
	Min/Max	1.1/3.5	2.2/4.1	2.2/4.2	2.5/5.2	2.7/4.8	3.3/6.1	4.1/6.3	4.0/6.0	2.3/5.3	2.4/4.4	1.8/3.6	1.4/3.1	3.0/4.0
1-Axis, N-S Horiz Axis	Average	1.5	2.3	3.3	4.4	5.0	6.3	7.1	6.4	4.9	3.3	1.8	1.4	4.0
	Min/Max	0.8/2.3	1.8/3.4	2.2/4.5	3.3/6.8	3.5/6.5	4.4/8.1	5.3/8.4	5.1/8.0	2.8/6.6	2.2/4.2	1.2/2.6	0.8/1.9	3.4/4.5
1-Axis, N-S Tilt=Latitude	Average	2.5	3.3	4.1	4.7	5.0	6.0	6.9	6.7	5.7	4.3	2.8	2.4	4.5
	Min/Max	1.2/3.8	2.6/4.9	2.8/5.6	3.6/7.4	3.5/6.4	4.2/7.7	5.2/8.2	5.4/8.3	3.3/7.6	3.0/5.6	2.0/4.1	1.4/3.3	3.8/5.1
2-Axis	Average	2.7	3.4	4.1	4.8	5.3	6.6	7.4	6.9	5.7	4.4	3.0	2.6	4.7
	Min/Max	1.3/4.1	2.6/5.0	2.8/5.6	3.6/7.5	3.7/6.8	4.6/8.4	5.6/8.8	5.5/8.6	3.3/7.6	3.0/5.7	2.1/4.3	1.6/3.5	4.0/5.3

Average Climatic Conditions

Element	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
Temperature (°C)	-6.2	-3.1	1.1	6.6	11.5	16.7	20.9	20.2	13.9	8.2	0.3	-5.2	7.1
Daily Minimum Temp	-13.1	-9.7	-5.8	-0.9	3.9	8.5	11.7	10.9	5.2	-0.2	-6.8	-12.1	-0.7
Daily Maximum Temp	0.6	3.5	7.9	13.9	19.1	24.9	30.1	29.6	22.7	16.5	7.4	1.7	14.8
Record Minimum Temp	-37.2	-35.6	-30.6	-18.9	-10.6	-2.8	1.7	1.1	-14.4	-22.8	-31.7	-38.3	-38.3
Record Maximum Temp	21.1	24.4	25.0	30.6	35.0	40.6	41.1	41.1	39.4	32.8	25.6	22.2	41.1
HDD, Base 18.3°C	761	601	536	353	212	87	16	35	149	315	542	730	4336
CDD, Base 18.3°C	0	0	0	0	0	38	94	93	18	0	0	0	244
Relative Humidity (%)	66	66	63	58	60	59	50	47	54	58	66	67	60
Wind Speed (m/s)	3.5	3.5	4.0	4.3	4.0	3.4	3.3	3.2	3.3	3.3	3.3	3.4	3.5