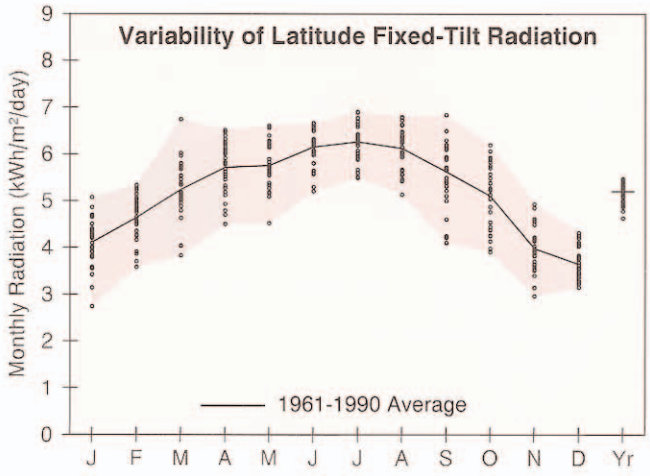
Grand Island, NE

WBAN NO. 14935

LATITUDE: 40.97° N
LONGITUDE: 98.32° W
ELEVATION: 566 meters
MEAN PRESSURE: 950 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	3.0	4.1	5.3	6.1	6.9	6.8	6.0	4.7	3.5	2.3	1.9	4.4
	Min/Max	1.7/2.5	2.6/3.3	3.3/5.0	4.4/6.0	4.8/6.9	5.9/7.5	6.0/7.5	5.1/6.6	3.7/5.5	2.9/4.1	2.0/2.7	1.8/2.1	4.1/4.6
Latitude -15	Average	3.6	4.2	5.0	5.8	6.1	6.7	6.8	6.4	5.5	4.7	3.5	3.1	5.1
	Min/Max	2.5/4.3	3.3/4.8	3.8/6.4	4.6/6.6	4.8/7.1	5.7/7.3	5.9/7.5	5.3/7.1	4.1/6.7	3.7/5.7	2.7/4.3	2.8/3.7	4.6/5.4
Latitude	Average	4.1	4.6	5.2	5.7	5.7	6.2	6.3	6.1	5.6	5.1	4.0	3.6	5.2
	Min/Max	2.7/5.1	3.6/5.3	3.8/6.7	4.5/6.5	4.5/6.6	5.2/6.7	5.5/6.9	5.1/6.8	4.1/6.8	3.9/6.2	3.0/4.9	3.2/4.3	4.6/5.5
Latitude +15	Average	4.4	4.8	5.2	5.3	5.1	5.3	5.5	5.6	5.4	5.2	4.2	3.9	5.0
	Min/Max	2.9/5.5	3.7/5.5	3.7/6.7	4.2/6.0	4.0/5.8	4.5/5.7	4.8/6.0	4.7/6.2	3.9/6.6	3.9/6.3	3.1/5.2	3.4/4.7	4.4/5.2
90	Average	4.2	4.3	4.0	3.4	2.9	2.7	2.8	3.3	3.8	4.2	3.8	3.8	3.6
	Min/Max	2.7/5.1	3.2/4.8	2.8/5.1	2.7/3.9	2.4/3.2	2.4/2.8	2.6/3.0	2.9/3.7	2.7/4.7	3.2/5.2	2.8/4.8	3.2/4.6	3.1/3.8

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	4.4	5.8	7.3	8.0	9.2	9.2	8.2	6.7	5.2	3.5	2.9	6.1
	Min/Max	2.3/4.2	3.3/5.2	4.1/7.5	5.4/8.6	6.0/9.4	7.5/10.3	7.8/10.5	6.4/9.3	4.8/8.3	3.9/6.3	2.5/4.3	2.5/3.4	5.5/6.6
Latitude -15	Average	4.4	5.3	6.5	7.7	8.2	9.2	9.3	8.6	7.3	6.1	4.3	3.8	6.7
	Min/Max	2.8/5.5	3.8/6.3	4.6/8.6	5.6/9.1	6.1/9.6	7.5/10.3	7.8/10.6	6.7/9.8	5.1/9.2	4.5/7.5	3.1/5.4	3.3/4.5	5.9/7.2
Latitude	Average	4.9	5.6	6.6	7.6	7.9	8.8	9.0	8.5	7.4	6.4	4.7	4.2	6.8
	Min/Max	3.1/6.1	4.1/6.7	4.6/8.8	5.5/9.1	5.9/9.4	7.2/9.9	7.6/10.2	6.6/9.6	5.1/9.4	4.6/7.9	3.3/5.9	3.6/5.0	5.9/7.3
Latitude +15	Average	5.1	5.8	6.6	7.3	7.4	8.2	8.4	8.0	7.2	6.4	4.9	4.5	6.7
	Min/Max	3.2/6.4	4.1/6.8	4.5/8.7	5.3/8.7	5.5/8.8	6.7/9.3	7.1/9.6	6.2/9.2	5.0/9.2	4.7/8.0	3.4/6.2	3.8/5.4	5.8/7.1

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

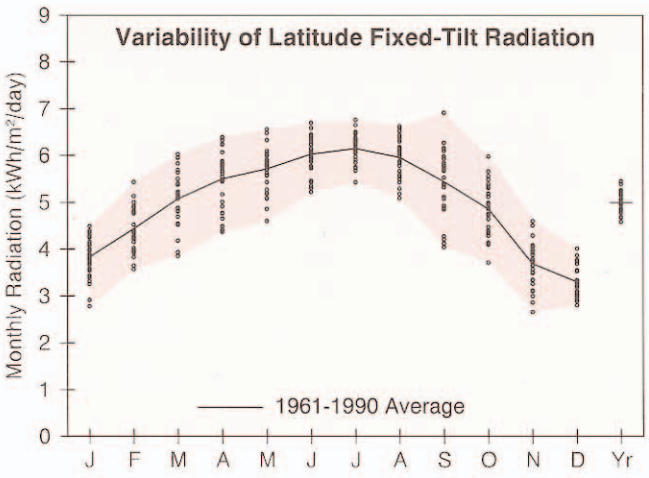
Tracker		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
2-Axis	Average	5.2	5.8	6.6	7.7	8.3	9.4	9.5	8.6	7.4	6.4	4.9	4.5	7.0
	Min/Max	3.2/6.5	4.2/6.8	4.6/8.8	5.6/9.2	6.1/9.8	7.6/10.5	8.0/10.8	6.8/9.8	5.2/9.4	4.7/8.0	3.5/6.2	3.9/5.5	6.1/7.5

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	3.2	3.3	3.7	3.9	4.8	4.9	4.4	3.8	3.7	2.9	2.8	3.7
	Min/Max	1.5/4.5	1.9/4.1	1.7/5.1	2.0/4.8	2.3/5.1	3.3/5.8	3.7/6.0	2.9/5.4	2.1/5.3	2.3/4.9	1.8/4.1	2.1/3.7	2.9/4.2
1-Axis, N-S Horiz Axis	Average	2.3	2.8	3.7	4.8	5.2	6.3	6.5	5.8	4.7	3.7	2.3	1.9	4.2
	Min/Max	1.0/3.3	1.5/3.8	1.8/5.7	2.6/6.4	3.1/6.8	4.4/7.7	4.9/8.0	3.8/7.2	2.6/6.5	2.3/4.9	1.3/3.1	1.4/2.5	3.4/4.7
1-Axis, N-S Tilt=Latitude	Average	3.5	3.8	4.4	5.1	5.1	6.0	6.3	6.0	5.3	4.7	3.3	3.0	4.7
	Min/Max	1.6/5.0	2.2/5.1	2.2/6.8	2.8/6.8	3.1/6.6	4.2/7.3	4.7/7.7	3.8/7.3	2.9/7.4	2.9/6.3	2.0/4.6	2.2/3.9	3.7/5.3
2-Axis	Average	3.7	3.9	4.4	5.2	5.4	6.5	6.7	6.1	5.3	4.7	3.5	3.3	4.9
	Min/Max	1.8/5.3	2.2/5.2	2.2/6.9	2.8/6.9	3.2/7.0	4.6/7.9	5.1/8.2	4.0/7.6	2.9/7.4	3.0/6.3	2.1/4.8	2.4/4.2	3.9/5.5

Average Climatic Conditions

Element	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
Temperature (°C)	-5.6	-2.6	3.2	10.4	16.3	21.9	24.8	23.3	17.7	11.3	3.1	-3.7	10.0
Daily Minimum Temp	-11.6	-8.7	-3.2	3.4	9.7	15.2	18.2	16.7	10.9	4.0	-3.2	-9.5	3.5
Daily Maximum Temp	0.3	3.4	9.6	17.5	22.9	28.7	31.4	29.9	24.6	18.6	9.3	2.1	16.6
Record Minimum Temp	-33.3	-28.3	-29.4	-13.9	-5.0	3.3	5.6	4.4	-5.0	-8.9	-23.9	-32.2	-33.3
Record Maximum Temp	24.4	25.0	32.2	35.6	38.3	41.7	42.8	43.3	40.0	35.6	27.8	24.4	43.3
HDD, Base 18.3°C	742	587	470	239	95	10	0	7	59	219	457	682	3567
CDD, Base 18.3°C	0	0	0	0	33	118	202	160	41	0	0	0	554
Relative Humidity (%)	69	70	66	61	64	63	65	67	68	63	69	71	66
Wind Speed (m/s)	5.4	5.3	6.0	6.2	5.6	5.2	4.6	4.5	4.8	4.9	5.2	5.2	5.2



Norfolk, NE

WBAN NO. 14941

LATITUDE: 41.98° N
LONGITUDE: 97.43° W
ELEVATION: 471 meters
MEAN PRESSURE: 960 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	2.9	4.0	5.1	6.0	6.7	6.7	5.8	4.5	3.3	2.2	1.7	4.3
	Min/Max	1.7/2.3	2.5/3.3	3.3/4.6	4.2/5.8	4.9/6.8	5.8/7.5	6.0/7.3	5.1/6.3	3.6/5.5	2.8/3.9	1.8/2.5	1.6/2.0	4.0/4.5
Latitude -15	Average	3.3	4.0	4.9	5.6	6.1	6.6	6.7	6.2	5.4	4.5	3.3	2.9	5.0
	Min/Max	2.5/3.9	3.3/4.9	3.8/5.8	4.5/6.5	4.9/7.0	5.7/7.3	5.9/7.3	5.3/6.9	4.1/6.7	3.5/5.5	2.4/4.0	2.5/3.4	4.6/5.4
Latitude	Average	3.8	4.4	5.1	5.5	5.7	6.0	6.2	6.0	5.4	4.9	3.7	3.3	5.0
	Min/Max	2.8/4.5	3.6/5.4	3.8/6.0	4.4/6.4	4.6/6.6	5.2/6.7	5.4/6.8	5.1/6.6	4.0/6.9	3.7/6.0	2.7/4.6	2.8/4.0	4.6/5.4
Latitude +15	Average	4.1	4.6	5.0	5.1	5.1	5.2	5.4	5.4	5.2	4.9	3.9	3.6	4.8
	Min/Max	3.0/4.9	3.7/5.7	3.7/5.9	4.1/5.9	4.1/5.8	4.5/5.8	4.7/5.9	4.6/6.0	3.8/6.7	3.7/6.1	2.7/4.9	3.0/4.3	4.3/5.2
90	Average	4.0	4.1	4.0	3.4	2.9	2.7	2.9	3.3	3.7	4.0	3.5	3.4	3.5
	Min/Max	2.8/4.8	3.2/5.1	2.8/4.8	2.8/3.9	2.5/3.2	2.5/2.9	2.6/3.1	2.9/3.7	2.7/4.8	3.0/5.1	2.4/4.5	2.9/4.2	3.1/3.8

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	3.1	4.1	5.5	6.9	7.9	8.9	9.0	7.9	6.4	4.9	3.1	2.6	5.9
	Min/Max	2.3/3.7	3.2/5.2	4.2/6.6	5.3/8.3	6.1/9.3	7.3/10.2	7.9/10.2	6.6/8.9	4.6/8.3	3.8/6.0	2.3/4.0	2.3/3.1	5.4/6.5
Latitude -15	Average	4.1	5.0	6.2	7.3	8.1	8.9	9.1	8.3	7.0	5.8	4.0	3.4	6.5
	Min/Max	2.9/4.8	3.8/6.4	4.6/7.5	5.6/8.9	6.2/9.6	7.3/10.3	8.0/10.3	6.9/9.4	4.9/9.3	4.3/7.2	2.8/5.1	2.9/4.2	5.8/7.2
Latitude	Average	4.5	5.3	6.4	7.3	7.9	8.6	8.8	8.2	7.1	6.0	4.3	3.8	6.5
	Min/Max	3.1/5.3	4.1/6.8	4.6/7.7	5.5/8.8	6.0/9.3	7.0/9.9	7.7/9.9	6.7/9.3	4.9/9.4	4.4/7.6	3.0/5.5	3.2/4.7	5.8/7.2
Latitude +15	Average	4.7	5.4	6.3	7.0	7.4	8.0	8.2	7.8	6.9	6.0	4.5	4.0	6.4
	Min/Max	3.3/5.6	4.2/7.0	4.5/7.7	5.3/8.5	5.7/8.8	6.5/9.2	7.2/9.3	6.4/8.8	4.8/9.2	4.4/7.6	3.0/5.8	3.3/4.9	5.7/7.1

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	4.8	5.4	6.4	7.4	8.2	9.2	9.3	8.4	7.1	6.1	4.5	4.1	6.7
	Min/Max	3.3/5.7	4.2/7.0	4.6/7.7	5.6/8.9	6.3/9.7	7.5/10.5	8.1/10.5	6.9/9.4	5.0/9.4	4.5/7.7	3.0/5.8	3.4/5.0	6.0/7.5

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	2.8	2.9	3.0	3.4	3.8	4.6	4.7	4.1	3.6	3.4	2.6	2.4	3.5
	Min/Max	1.4/3.7	1.8/4.2	1.4/4.3	1.8/4.6	2.5/5.0	3.3/5.9	3.8/5.7	3.0/5.1	2.0/5.4	2.1/4.7	1.5/3.7	1.7/3.4	2.9/4.1
1-Axis, N-S Horiz Axis	Average	2.0	2.5	3.4	4.4	5.1	6.0	6.2	5.5	4.3	3.3	2.0	1.6	3.9
	Min/Max	1.0/2.6	1.5/3.8	1.6/4.8	2.5/6.0	3.3/6.7	4.2/7.7	4.9/7.6	3.9/6.7	2.4/6.5	2.1/4.6	1.1/2.9	1.1/2.2	3.3/4.6
1-Axis, N-S Tilt=Latitude	Average	3.1	3.5	4.1	4.7	5.0	5.7	6.0	5.6	4.9	4.3	3.0	2.5	4.4
	Min/Max	1.5/4.1	2.1/5.1	1.9/5.7	2.6/6.4	3.3/6.6	4.0/7.3	4.7/7.3	4.0/6.9	2.7/7.4	2.7/5.9	1.6/4.2	1.8/3.6	3.6/5.2
2-Axis	Average	3.3	3.6	4.1	4.8	5.3	6.2	6.4	5.8	5.0	4.4	3.1	2.8	4.6
	Min/Max	1.6/4.3	2.2/5.2	1.9/5.8	2.7/6.5	3.4/6.9	4.3/7.9	5.1/7.8	4.1/7.1	2.8/7.5	2.7/6.0	1.7/4.4	1.9/3.9	3.8/5.4

Average Climatic Conditions

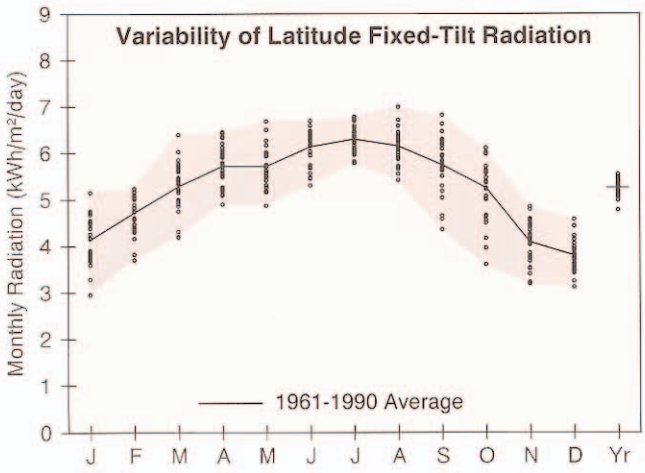
Element	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
Temperature (°C)	-7.2	-4.2	2.1	9.8	16.1	21.3	24.1	22.6	17.3	10.8	2.3	-5.1	9.2
Daily Minimum Temp	-13.1	-9.9	-3.9	3.1	9.6	14.8	17.8	16.2	10.6	3.7	-3.6	-10.7	2.9
Daily Maximum Temp	-1.3	1.5	7.9	16.4	22.6	27.8	30.4	28.8	23.9	17.8	8.3	0.4	15.4
Record Minimum Temp	-32.8	-32.2	-28.9	-16.7	-4.4	3.3	5.6	4.4	-3.3	-10.6	-26.1	-34.4	-34.4
Record Maximum Temp	21.7	22.8	31.1	35.0	39.4	41.1	45.0	41.7	38.3	35.0	27.8	21.7	45.0
HDD, Base 18.3°C	792	632	504	255	102	12	0	9	69	237	480	727	3818
CDD, Base 18.3°C	0	0	0	0	31	101	179	139	37	0	0	0	487
Relative Humidity (%)	68	70	68	61	62	62	65	68	67	64	69	72	66
Wind Speed (m/s)	5.6	5.3	6.0	6.1	5.5	4.9	4.4	4.4	4.8	5.0	5.4	5.4	5.2

North Platte, NE

WBAN NO. 24023

LATITUDE: 41.13° N
LONGITUDE: 100.68° W
ELEVATION: 849 meters
MEAN PRESSURE: 917 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	6.8	6.8	6.0	4.8	3.6	2.4	1.9	4.4
	Min/Max	1.8/2.5	2.6/3.3	3.5/4.8	4.7/5.9	5.3/7.0	5.9/7.5	6.2/7.3	5.3/6.7	3.9/5.5	2.7/4.0	2.0/2.6	1.8/2.2	4.2/4.6
Latitude -15	Average	3.6	4.3	5.1	5.8	6.1	6.7	6.8	6.4	5.7	4.9	3.6	3.3	5.2
	Min/Max	2.6/4.4	3.4/4.7	4.1/6.1	5.0/6.6	5.2/7.1	5.8/7.3	6.2/7.3	5.6/7.2	4.4/6.7	3.4/5.6	2.9/4.3	2.7/3.9	4.8/5.4
Latitude	Average	4.1	4.7	5.3	5.7	5.7	6.1	6.3	6.1	5.7	5.3	4.1	3.8	5.3
	Min/Max	3.0/5.2	3.7/5.2	4.2/6.4	4.9/6.4	4.9/6.7	5.3/6.7	5.8/6.8	5.4/7.0	4.3/6.8	3.6/6.1	3.2/4.8	3.1/4.6	4.8/5.5
Latitude +15	Average	4.4	4.9	5.2	5.3	5.1	5.3	5.5	5.6	5.5	5.3	4.3	4.1	5.0
	Min/Max	3.1/5.6	3.8/5.4	4.1/6.3	4.6/6.0	4.3/5.9	4.6/5.7	5.0/5.9	4.9/6.3	4.1/6.6	3.6/6.2	3.3/5.2	3.3/5.0	4.5/5.3
90	Average	4.2	4.3	4.0	3.5	2.8	2.7	2.9	3.3	3.9	4.4	3.9	3.9	3.7
	Min/Max	2.9/5.3	3.2/4.9	3.1/4.8	3.0/3.8	2.5/3.2	2.4/2.8	2.7/3.0	3.0/3.7	2.9/4.7	2.9/5.2	3.0/4.7	3.2/4.8	3.2/3.9

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	4.5	5.8	7.3	7.9	9.1	9.2	8.2	6.8	5.3	3.5	3.0	6.2
	Min/Max	2.4/4.2	3.4/5.0	4.3/7.2	5.9/8.5	6.7/9.6	7.6/10.2	7.9/10.1	6.9/9.6	5.1/8.3	3.6/6.3	2.8/4.1	2.5/3.6	5.6/6.5
Latitude -15	Average	4.4	5.4	6.5	7.8	8.1	9.1	9.3	8.6	7.5	6.3	4.5	4.0	6.8
	Min/Max	3.0/5.6	4.1/6.1	4.8/8.2	6.2/9.1	6.7/9.8	7.6/10.3	8.0/10.2	7.2/10.1	5.5/9.2	4.1/7.5	3.4/5.3	3.2/4.8	6.0/7.2
Latitude	Average	4.9	5.7	6.7	7.7	7.8	8.8	9.0	8.5	7.5	6.6	4.8	4.4	6.9
	Min/Max	3.3/6.2	4.3/6.5	4.9/8.4	6.2/9.0	6.5/9.5	7.3/9.9	7.7/9.9	7.1/10.0	5.4/9.4	4.3/7.8	3.7/5.8	3.5/5.4	6.1/7.3
Latitude +15	Average	5.1	5.9	6.6	7.4	7.4	8.2	8.4	8.1	7.4	6.6	5.0	4.7	6.7
	Min/Max	3.4/6.5	4.3/6.7	4.8/8.3	5.9/8.6	6.1/9.0	6.8/9.2	7.2/9.3	6.7/9.5	5.3/9.2	4.3/7.9	3.8/6.1	3.7/5.7	5.9/7.1

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

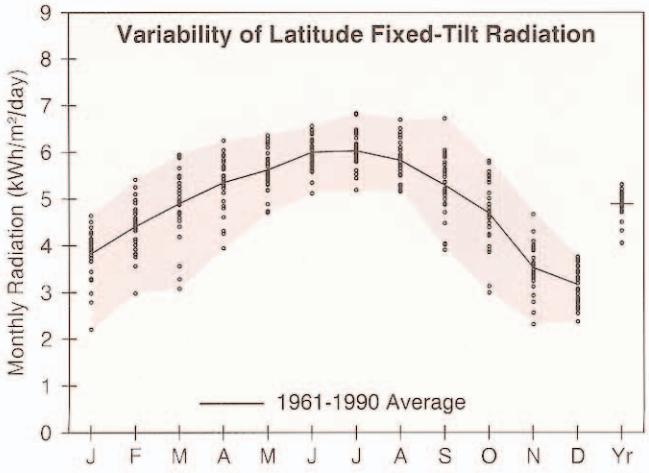
Tracker		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
2-Axis	Average	5.2	5.9	6.7	7.8	8.2	9.4	9.5	8.7	7.6	6.7	5.0	4.7	7.1
	Min/Max	3.5/6.6	4.4/6.7	4.9/8.4	6.3/9.1	6.8/9.9	7.7/10.5	8.2/10.4	7.3/10.2	5.5/9.4	4.3/7.9	3.8/6.1	3.8/5.8	6.3/7.5

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	3.2	3.3	3.7	3.9	4.9	5.0	4.5	4.0	3.8	3.0	3.0	3.8
	Min/Max	1.7/4.6	2.1/4.1	1.9/4.7	2.5/4.7	2.6/5.3	3.5/5.9	4.0/5.8	3.3/5.8	2.3/5.4	2.0/4.9	1.7/4.0	2.0/4.1	3.1/4.2
1-Axis, N-S Horiz Axis	Average	2.2	2.9	3.7	4.9	5.2	6.4	6.6	5.9	4.8	3.8	2.3	2.0	4.2
	Min/Max	1.1/3.3	1.8/3.7	2.0/5.4	3.2/6.3	3.5/7.1	4.5/7.8	5.1/7.7	4.3/7.6	2.8/6.7	1.9/4.9	1.3/3.0	1.3/2.8	3.4/4.6
1-Axis, N-S Tilt=Latitude	Average	3.4	3.9	4.4	5.2	5.1	6.0	6.3	6.0	5.5	4.9	3.4	3.2	4.8
	Min/Max	1.8/5.0	2.5/5.0	2.5/6.4	3.4/6.7	3.5/6.9	4.3/7.3	4.9/7.3	4.4/7.8	3.2/7.5	2.5/6.2	1.9/4.5	2.1/4.4	3.8/5.2
2-Axis	Average	3.7	4.0	4.4	5.3	5.4	6.6	6.8	6.2	5.5	5.0	3.6	3.4	5.0
	Min/Max	2.0/5.4	2.6/5.2	2.5/6.4	3.5/6.8	3.7/7.3	4.7/8.0	5.3/7.9	4.5/8.0	3.2/7.6	2.5/6.3	2.0/4.7	2.3/4.8	4.0/5.5

Average Climatic Conditions

Element	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
Temperature (°C)	-5.8	-2.4	2.5	9.0	14.6	19.9	23.3	22.1	16.3	9.8	1.9	-4.3	8.9
Daily Minimum Temp	-13.0	-9.8	-5.0	1.1	7.0	12.3	15.6	14.2	7.9	0.8	-5.9	-11.6	1.1
Daily Maximum Temp	1.4	4.9	9.9	16.9	22.1	27.6	31.0	30.0	24.8	18.7	9.7	2.9	16.7
Record Minimum Temp	-30.6	-30.0	-30.0	-13.9	-7.2	-1.7	4.4	1.7	-8.3	-12.2	-25.0	-36.7	-36.7
Record Maximum Temp	22.8	26.1	30.0	34.4	36.1	41.7	44.4	40.6	38.9	34.4	27.8	23.9	44.4
HDD, Base 18.3°C	747	582	491	280	130	27	0	6	88	263	493	703	3811
CDD, Base 18.3°C	0	0	0	0	13	76	157	123	28	0	0	0	396
Relative Humidity (%)	69	68	65	60	63	64	63	64	64	62	67	69	65
Wind Speed (m/s)	4.2	4.3	5.2	5.6	5.1	4.5	4.3	4.1	4.3	4.2	4.2	4.1	4.5



Omaha, NE

WBAN NO. 94918

LATITUDE: 41.37° N
LONGITUDE: 96.52° W
ELEVATION: 404 meters
MEAN PRESSURE: 976 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	2.1	2.9	3.9	5.0	5.9	6.7	6.6	5.7	4.5	3.3	2.1	1.7	4.2
	Min/Max	1.6/2.4	2.3/3.3	2.7/4.6	3.9/5.7	5.0/6.7	5.7/7.4	5.7/7.4	5.1/6.5	3.6/5.4	2.3/3.9	1.6/2.5	1.5/1.9	3.7/4.4
Latitude -15	Average	3.3	4.0	4.7	5.5	6.0	6.5	6.5	6.1	5.2	4.4	3.2	2.7	4.9
	Min/Max	2.0/4.0	2.8/4.9	3.0/5.7	4.1/6.3	5.0/6.8	5.6/7.2	5.6/7.4	5.4/6.9	4.0/6.6	2.9/5.4	2.1/4.1	2.1/3.2	4.1/5.2
Latitude	Average	3.8	4.4	4.9	5.3	5.6	6.0	6.0	5.8	5.3	4.7	3.5	3.2	4.9
	Min/Max	2.2/4.6	3.0/5.4	3.1/5.9	3.9/6.3	4.7/6.4	5.1/6.6	5.2/6.8	5.2/6.7	3.9/6.7	3.0/5.8	2.3/4.7	2.4/3.8	4.0/5.3
Latitude +15	Average	4.1	4.6	4.8	5.0	5.0	5.2	5.3	5.3	5.1	4.7	3.7	3.4	4.7
	Min/Max	2.3/5.0	3.0/5.6	3.0/5.8	3.6/5.8	4.2/5.6	4.5/5.7	4.6/6.0	4.7/6.1	3.7/6.5	3.0/5.9	2.4/5.0	2.5/4.1	3.8/5.1
90	Average	3.9	4.1	3.8	3.2	2.8	2.7	2.8	3.2	3.6	3.9	3.3	3.2	3.4
	Min/Max	2.1/4.7	2.6/4.9	2.3/4.7	2.5/3.9	2.4/3.1	2.4/2.9	2.5/3.1	2.9/3.7	2.6/4.6	2.3/4.8	2.1/4.5	2.3/4.0	2.7/3.7

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	3.1	4.1	5.3	6.6	7.6	8.7	8.5	7.6	6.1	4.7	3.0	2.5	5.7
	Min/Max	1.8/3.8	2.7/5.0	3.1/6.6	4.5/8.1	6.1/9.0	6.9/10.0	7.2/10.0	6.5/8.7	4.5/7.9	2.9/5.8	2.0/4.0	1.9/3.0	4.6/6.2
Latitude -15	Average	4.1	5.0	6.0	7.0	7.8	8.7	8.6	8.0	6.7	5.5	3.8	3.3	6.2
	Min/Max	2.2/5.0	3.2/6.2	3.4/7.5	4.7/8.7	6.2/9.2	6.9/10.1	7.2/10.1	6.8/9.2	4.8/8.8	3.3/6.9	2.4/5.2	2.4/4.0	4.9/6.8
Latitude	Average	4.5	5.3	6.1	7.0	7.5	8.3	8.3	7.8	6.7	5.7	4.1	3.6	6.3
	Min/Max	2.4/5.5	3.3/6.6	3.4/7.7	4.6/8.6	5.9/8.9	6.6/9.7	6.9/9.8	6.7/9.0	4.8/8.9	3.4/7.3	2.6/5.6	2.6/4.4	4.9/6.9
Latitude +15	Average	4.7	5.4	6.0	6.7	7.1	7.8	7.8	7.4	6.6	5.8	4.2	3.8	6.1
	Min/Max	2.5/5.8	3.3/6.8	3.3/7.6	4.4/8.3	5.6/8.4	6.1/9.0	6.5/9.2	6.3/8.6	4.6/8.7	3.4/7.3	2.7/5.8	2.7/4.7	4.7/6.7

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	4.7	5.4	6.1	7.1	7.9	8.9	8.8	8.0	6.8	5.8	4.3	3.9	6.5
	Min/Max	2.5/5.9	3.3/6.8	3.4/7.7	4.7/8.7	6.2/9.3	7.0/10.3	7.3/10.3	6.8/9.2	4.8/8.9	3.5/7.3	2.7/5.9	2.8/4.7	5.1/7.1

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	2.8	2.9	3.0	3.3	3.6	4.2	4.2	3.8	3.4	3.2	2.5	2.3	3.3
	Min/Max	0.8/3.9	1.2/4.3	1.0/4.2	1.6/4.3	2.1/4.8	2.9/5.6	3.0/5.4	2.8/4.7	1.8/5.1	1.5/4.4	1.1/3.8	1.4/3.1	2.2/3.7
1-Axis, N-S Horiz Axis	Average	2.0	2.5	3.3	4.2	4.7	5.5	5.5	4.9	4.0	3.1	1.9	1.5	3.6
	Min/Max	0.6/2.8	1.0/3.8	1.0/4.7	1.9/5.7	2.8/6.3	3.7/7.4	4.0/7.1	3.7/6.2	2.3/6.0	1.5/4.3	0.8/2.9	0.9/2.0	2.4/4.1
1-Axis, N-S Tilt=Latitude	Average	3.0	3.5	3.9	4.4	4.6	5.2	5.3	5.1	4.5	4.0	2.8	2.4	4.1
	Min/Max	0.9/4.3	1.4/5.2	1.2/5.6	2.0/6.1	2.8/6.2	3.5/7.0	3.8/6.8	3.8/6.4	2.5/6.8	1.9/5.5	1.2/4.3	1.5/3.3	2.7/4.7
2-Axis	Average	3.3	3.6	3.9	4.5	4.9	5.7	5.7	5.2	4.6	4.1	2.9	2.6	4.2
	Min/Max	0.9/4.6	1.4/5.3	1.2/5.6	2.1/6.2	2.9/6.6	3.8/7.6	4.1/7.3	3.9/6.6	2.5/6.9	1.9/5.5	1.3/4.5	1.6/3.5	2.8/4.9

Average Climatic Conditions

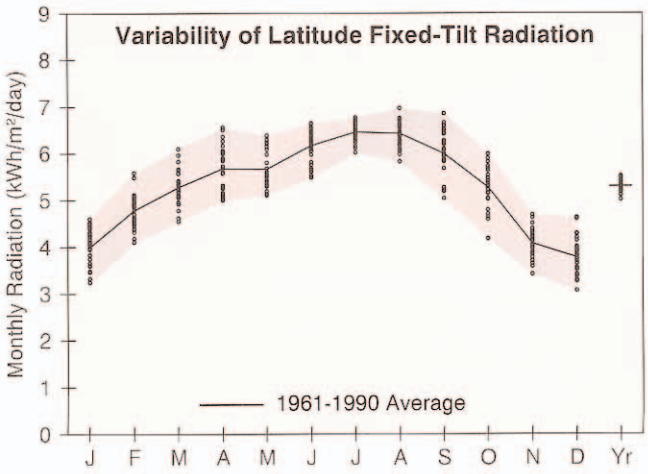
Element	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
Temperature (°C)	-6.4	-3.4	3.2	10.8	16.9	22.2	24.7	23.3	18.2	12.0	3.7	-4.2	10.1
Daily Minimum Temp	-11.6	-8.6	-2.3	4.6	11.0	16.3	19.2	17.7	12.6	6.1	-1.3	-8.9	4.6
Daily Maximum Temp	-1.3	1.7	8.7	16.9	22.7	28.0	30.3	28.9	23.8	17.8	8.7	0.5	15.6
Record Minimum Temp	-30.6	-29.4	-26.7	-15.0	-2.8	3.3	6.7	6.1	-3.9	-10.6	-22.8	-30.6	-30.6
Record Maximum Temp	20.6	25.6	31.7	36.1	37.2	40.6	45.6	43.3	40.0	35.6	26.7	22.2	45.6
HDD, Base 18.3°C	767	608	470	230	86	6	0	6	50	202	438	699	3563
CDD, Base 18.3°C	0	0	0	3	42	121	198	159	47	6	0	0	576
Relative Humidity (%)	71	71	67	61	64	65	68	70	71	67	71	73	68
Wind Speed (m/s)	4.6	4.6	5.1	5.2	4.4	4.0	3.7	3.6	3.9	4.1	4.5	4.5	4.3

Scottsbluff, NE

WBAN NO. 24028

LATITUDE: 41.87° N
LONGITUDE: 103.60° W
ELEVATION: 1206 meters
MEAN PRESSURE: 879 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	4.1	5.3	6.0	6.9	7.0	6.2	4.9	3.5	2.3	1.9	4.4
	Min/Max	1.9/2.3	2.7/3.3	3.7/4.5	4.7/5.9	5.4/6.7	6.1/7.4	6.5/7.3	5.6/6.7	4.3/5.5	3.0/3.9	2.1/2.5	1.6/2.1	4.3/4.6
Latitude -15	Average	3.5	4.3	5.1	5.8	6.0	6.7	7.0	6.7	5.9	4.9	3.6	3.2	5.2
	Min/Max	2.9/4.0	3.8/5.0	4.4/5.8	5.1/6.7	5.4/6.8	5.9/7.2	6.5/7.3	6.0/7.2	5.0/6.7	4.0/5.5	3.1/4.1	2.7/3.9	5.0/5.4
Latitude	Average	4.0	4.8	5.3	5.7	5.7	6.2	6.5	6.4	6.0	5.3	4.1	3.8	5.3
	Min/Max	3.2/4.6	4.1/5.6	4.5/6.1	5.0/6.6	5.1/6.4	5.5/6.6	6.0/6.8	5.8/7.0	5.0/6.8	4.2/6.0	3.4/4.7	3.1/4.6	5.0/5.5
Latitude +15	Average	4.3	4.9	5.2	5.3	5.0	5.3	5.6	5.8	5.7	5.3	4.3	4.1	5.1
	Min/Max	3.4/5.0	4.2/5.8	4.4/6.0	4.6/6.1	4.5/5.6	4.7/5.7	5.2/5.9	5.3/6.3	4.8/6.6	4.2/6.1	3.5/5.0	3.3/5.1	4.8/5.3
90	Average	4.1	4.4	4.1	3.5	2.9	2.7	3.0	3.5	4.1	4.4	3.9	3.9	3.7
	Min/Max	3.1/4.8	3.6/5.2	3.5/4.7	3.1/4.1	2.6/3.1	2.6/2.9	2.8/3.1	3.3/3.8	3.4/4.7	3.4/5.1	3.2/4.6	3.1/5.0	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	3.3	4.5	5.8	7.2	7.9	9.2	9.5	8.6	7.1	5.3	3.5	2.9	6.2
	Min/Max	2.5/3.8	3.8/5.3	4.8/6.7	6.1/8.5	6.8/9.1	7.6/10.4	8.7/10.1	7.4/9.6	5.6/8.4	4.1/6.1	3.0/4.0	2.4/3.6	5.9/6.5
Latitude -15	Average	4.3	5.5	6.5	7.6	8.1	9.2	9.6	9.1	7.9	6.3	4.4	3.9	6.9
	Min/Max	3.3/5.0	4.7/6.5	5.4/7.7	6.5/9.1	6.9/9.3	7.6/10.4	8.8/10.2	7.8/10.1	6.2/9.3	4.8/7.3	3.7/5.2	3.1/4.9	6.5/7.2
Latitude	Average	4.7	5.8	6.7	7.6	7.8	8.9	9.2	8.9	7.9	6.6	4.8	4.4	6.9
	Min/Max	3.6/5.5	4.9/7.0	5.6/7.9	6.4/9.1	6.7/9.0	7.3/10.0	8.4/9.9	7.6/10.0	6.3/9.5	5.0/7.7	4.0/5.6	3.5/5.5	6.5/7.3
Latitude +15	Average	4.9	5.9	6.6	7.3	7.4	8.3	8.7	8.5	7.8	6.7	5.0	4.6	6.8
	Min/Max	3.8/5.8	5.0/7.2	5.5/7.8	6.2/8.8	6.3/8.5	6.8/9.3	7.9/9.3	7.2/9.5	6.1/9.3	5.0/7.8	4.1/5.8	3.7/5.8	6.4/7.2

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	5.9	6.7	7.7	8.2	9.4	9.8	9.1	8.0	6.7	5.0	4.7	7.2
	Min/Max	3.8/5.9	5.0/7.2	5.6/7.9	6.5/9.2	7.0/9.4	7.8/10.6	8.9/10.4	7.8/10.2	6.3/9.5	5.0/7.8	4.2/5.9	3.7/5.9	6.7/7.6

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	3.3	3.3	3.6	3.9	5.0	5.4	4.9	4.3	3.9	3.0	3.0	3.9
	Min/Max	2.2/4.0	2.7/4.4	2.4/4.5	2.8/4.9	2.9/4.9	3.7/5.9	4.7/5.9	4.0/5.8	3.0/5.5	2.4/4.8	2.2/3.9	2.2/4.2	3.5/4.2
1-Axis, N-S Horiz Axis	Average	2.1	3.0	3.7	4.7	5.2	6.6	7.0	6.4	5.2	3.8	2.3	1.9	4.3
	Min/Max	1.4/2.9	2.3/4.0	2.6/5.0	3.5/6.4	3.8/6.5	4.7/7.8	6.1/7.8	5.0/7.6	3.5/6.8	2.4/4.9	1.7/3.0	1.4/2.8	3.9/4.7
1-Axis, N-S Tilt=Latitude	Average	3.3	4.0	4.4	5.0	5.1	6.2	6.7	6.6	6.0	5.0	3.4	3.1	4.9
	Min/Max	2.3/4.4	3.2/5.4	3.2/6.0	3.8/6.9	3.8/6.4	4.5/7.4	5.8/7.5	5.2/7.9	4.0/7.7	3.1/6.2	2.5/4.4	2.3/4.4	4.4/5.3
2-Axis	Average	3.5	4.2	4.4	5.1	5.4	6.8	7.2	6.8	6.0	5.0	3.6	3.4	5.1
	Min/Max	2.5/4.7	3.3/5.6	3.2/6.0	3.9/7.0	4.0/6.8	4.9/8.0	6.3/8.1	5.3/8.1	4.0/7.8	3.1/6.3	2.6/4.6	2.5/4.8	4.6/5.6

Average Climatic Conditions

Element	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
Temperature (°C)	-3.9	-1.0	2.3	8.1	13.6	19.6	23.4	22.0	16.3	9.8	2.4	-3.2	9.1
Daily Minimum Temp	-11.2	-8.4	-5.5	-0.3	5.4	11.5	14.8	13.3	7.6	0.9	-5.3	-10.6	1.0
Daily Maximum Temp	3.3	6.4	10.2	16.3	21.6	27.8	32.1	30.7	25.1	18.6	10.1	4.2	17.2
Record Minimum Temp	-35.6	-33.3	-32.8	-22.2	-9.4	-1.1	4.4	3.9	-7.2	-21.1	-25.0	-41.1	-41.1
Record Maximum Temp	23.3	25.0	30.6	33.3	35.0	41.1	42.8	40.0	38.3	33.3	26.7	25.0	42.8
HDD, Base 18.3°C	691	541	496	308	154	34	0	5	97	265	478	668	3738
CDD, Base 18.3°C	0	0	0	0	7	72	161	119	37	0	0	0	396
Relative Humidity (%)	64	63	60	56	58	57	56	58	57	56	62	65	59
Wind Speed (m/s)	5.1	5.1	5.5	5.7	5.3	4.7	4.2	4.0	4.2	4.3	4.5	4.7	4.7