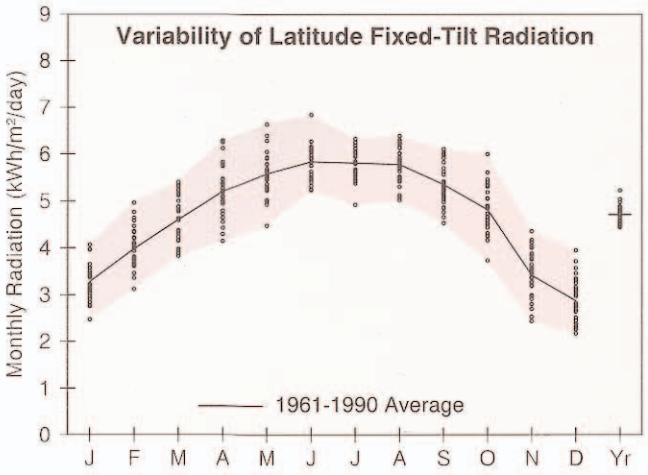
Evansville, IN

WBAN NO. 93817

LATITUDE: 38.05° N
LONGITUDE: 87.53° W
ELEVATION: 118 meters
MEAN PRESSURE: 1004 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	3.8	5.0	5.9	6.5	6.3	5.7	4.6	3.5	2.3	1.8	4.2
	Min/Max	1.8/2.5	2.5/3.3	3.4/4.3	4.1/5.9	4.8/7.0	5.8/7.7	5.3/6.9	5.0/6.3	4.1/5.2	2.9/4.2	1.9/2.7	1.5/2.2	4.0/4.6
Latitude -15	Average	2.9	3.7	4.5	5.3	5.9	6.3	6.2	6.0	5.3	4.5	3.1	2.5	4.7
	Min/Max	2.3/3.5	3.0/4.5	3.8/5.2	4.3/6.4	4.8/7.1	5.7/7.5	5.3/6.8	5.2/6.6	4.5/6.0	3.5/5.5	2.3/3.8	2.0/3.4	4.4/5.2
Latitude	Average	3.3	4.0	4.6	5.2	5.6	5.8	5.8	5.8	5.3	4.8	3.4	2.9	4.7
	Min/Max	2.5/4.1	3.1/5.0	3.8/5.4	4.1/6.3	4.5/6.6	5.2/6.8	4.9/6.3	5.0/6.4	4.5/6.1	3.7/6.0	2.4/4.3	2.2/4.0	4.4/5.2
Latitude +15	Average	3.5	4.1	4.5	4.8	4.9	5.0	5.1	5.3	5.1	4.9	3.6	3.0	4.5
	Min/Max	2.5/4.4	3.1/5.2	3.7/5.3	3.8/5.8	4.0/5.8	4.6/5.8	4.3/5.5	4.6/5.8	4.3/5.9	3.7/6.1	2.5/4.6	2.3/4.3	4.2/5.0
90	Average	3.1	3.4	3.3	3.0	2.6	2.4	2.5	3.0	3.5	3.8	3.1	2.8	3.0
	Min/Max	2.2/4.1	2.6/4.5	2.7/3.9	2.4/3.6	2.2/2.9	2.3/2.6	2.3/2.7	2.6/3.3	2.9/4.0	2.9/4.9	2.0/4.1	2.0/4.0	2.8/3.3

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	2.9	3.9	5.1	6.5	7.7	8.4	8.2	7.6	6.2	4.9	3.1	2.4	5.6
	Min/Max	2.2/3.6	3.1/4.8	4.1/6.1	5.0/8.2	5.8/9.6	7.2/10.4	6.5/9.1	6.4/8.5	5.2/7.3	3.7/6.3	2.3/3.9	1.8/3.3	5.2/6.4
Latitude -15	Average	3.5	4.5	5.6	6.8	7.7	8.4	8.2	7.8	6.7	5.7	3.7	3.0	6.0
	Min/Max	2.6/4.4	3.4/5.7	4.4/6.8	5.2/8.6	5.9/9.8	7.1/10.4	6.5/9.1	6.6/8.8	5.6/7.9	4.2/7.2	2.6/4.8	2.2/4.2	5.6/6.8
Latitude	Average	3.8	4.7	5.7	6.7	7.5	8.1	7.9	7.7	6.8	5.9	4.0	3.3	6.0
	Min/Max	2.8/4.8	3.6/6.1	4.5/6.9	5.1/8.5	5.7/9.5	6.8/10.0	6.3/8.8	6.4/8.6	5.6/8.0	4.3/7.6	2.7/5.2	2.3/4.6	5.6/6.9
Latitude +15	Average	3.9	4.8	5.6	6.4	7.1	7.5	7.4	7.3	6.6	5.9	4.1	3.4	5.9
	Min/Max	2.8/5.0	3.6/6.2	4.4/6.8	4.9/8.2	5.3/9.0	6.3/9.3	5.9/8.3	6.1/8.2	5.4/7.9	4.3/7.7	2.7/5.4	2.4/4.9	5.5/6.7

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

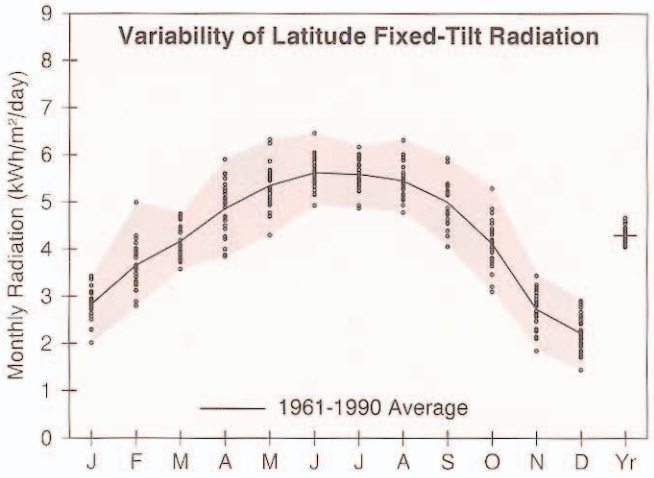
Tracker		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
2-Axis	Average	4.0	4.8	5.7	6.8	7.8	8.6	8.4	7.9	6.8	6.0	4.1	3.5	6.2
	Min/Max	2.8/5.1	3.6/6.2	4.5/6.9	5.2/8.6	5.9/9.9	7.3/10.6	6.7/9.3	6.6/8.8	5.6/8.1	4.4/7.7	2.8/5.4	2.4/5.0	5.8/7.1

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	2.2	2.4	2.6	3.0	3.6	4.1	3.9	3.6	3.3	3.2	2.3	1.9	3.0
	Min/Max	1.3/3.2	1.4/3.5	1.7/3.6	1.8/4.4	2.1/5.3	2.8/5.9	2.5/4.8	2.6/4.5	2.4/4.2	2.0/4.6	1.2/3.3	1.1/3.2	2.7/3.8
1-Axis, N-S Horiz Axis	Average	1.6	2.3	3.0	4.0	4.8	5.4	5.2	4.8	4.0	3.3	1.8	1.4	3.5
	Min/Max	1.0/2.4	1.4/3.2	1.9/4.2	2.3/5.8	2.9/7.1	3.7/7.8	3.4/6.3	3.5/5.9	2.9/5.3	2.0/4.7	1.0/2.7	0.8/2.3	3.1/4.4
1-Axis, N-S Tilt=Latitude	Average	2.4	3.0	3.5	4.2	4.6	5.0	4.9	4.9	4.4	4.1	2.6	2.1	3.8
	Min/Max	1.4/3.5	1.8/4.2	2.2/4.9	2.4/6.1	2.8/6.9	3.5/7.3	3.2/6.0	3.5/6.0	3.3/5.8	2.5/5.8	1.4/3.8	1.2/3.5	3.4/4.8
2-Axis	Average	2.6	3.1	3.5	4.2	4.9	5.5	5.3	5.0	4.4	4.1	2.7	2.2	4.0
	Min/Max	1.5/3.7	1.8/4.3	2.2/4.9	2.4/6.2	3.0/7.3	3.8/7.9	3.4/6.4	3.6/6.2	3.3/5.9	2.5/5.9	1.4/3.9	1.3/3.8	3.6/5.0

Average Climatic Conditions

Element	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
Temperature (°C)	-1.1	1.3	7.7	13.4	18.6	23.8	25.8	24.5	20.7	14.0	7.9	1.8	13.2
Daily Minimum Temp	-6.0	-3.9	2.1	7.2	12.3	17.4	19.7	18.3	14.2	7.1	2.5	-2.9	7.3
Daily Maximum Temp	3.8	6.5	13.3	19.7	24.9	30.1	31.7	30.7	27.1	20.9	13.3	6.4	19.1
Record Minimum Temp	-29.4	-30.6	-22.8	-5.0	-2.2	5.0	8.3	6.1	-0.6	-6.1	-19.4	-26.1	-30.6
Record Maximum Temp	24.4	26.1	28.9	32.8	35.0	40.0	40.6	38.9	39.4	34.4	28.3	25.0	40.6
HDD, Base 18.3°C	601	476	331	152	63	0	0	0	18	148	313	513	2616
CDD, Base 18.3°C	0	0	0	5	72	163	231	191	88	14	0	0	764
Relative Humidity (%)	72	71	68	65	68	68	71	73	73	69	71	74	70
Wind Speed (m/s)	4.0	4.0	4.3	4.1	3.4	3.1	2.7	2.5	2.7	3.0	3.6	3.8	3.4



Fort Wayne, IN

WBAN NO. 14827

LATITUDE: 41.00° N
LONGITUDE: 85.20° W
ELEVATION: 252 meters
MEAN PRESSURE: 987 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	2.6	3.5	4.6	5.6	6.2	6.1	5.3	4.3	3.0	1.8	1.4	3.9
	Min/Max	1.4/2.0	2.2/3.3	3.2/3.9	3.8/5.4	4.6/6.7	5.5/7.2	5.3/6.7	4.8/6.1	3.7/4.9	2.5/3.6	1.5/2.1	1.1/1.7	3.7/4.2
Latitude -15	Average	2.5	3.4	4.1	5.0	5.7	6.1	6.0	5.7	5.0	3.9	2.5	2.0	4.3
	Min/Max	1.9/3.0	2.7/4.5	3.6/4.6	4.0/6.0	4.6/6.8	5.3/7.0	5.2/6.7	5.0/6.5	4.1/5.8	3.0/4.9	1.8/3.1	1.4/2.5	4.1/4.7
Latitude	Average	2.8	3.7	4.2	4.9	5.4	5.6	5.6	5.4	5.0	4.1	2.7	2.2	4.3
	Min/Max	2.0/3.4	2.8/5.0	3.6/4.8	3.8/5.9	4.3/6.3	4.9/6.5	4.9/6.2	4.8/6.3	4.1/5.9	3.1/5.3	1.9/3.4	1.4/2.9	4.1/4.7
Latitude +15	Average	3.0	3.8	4.1	4.5	4.8	4.9	4.9	4.9	4.8	4.1	2.8	2.3	4.1
	Min/Max	2.1/3.7	2.8/5.2	3.5/4.6	3.5/5.5	3.8/5.6	4.3/5.6	4.3/5.4	4.3/5.7	3.8/5.7	3.0/5.4	1.8/3.6	1.5/3.1	3.8/4.4
90	Average	2.8	3.3	3.1	2.9	2.7	2.6	2.7	3.0	3.4	3.4	2.5	2.2	2.9
	Min/Max	1.8/3.5	2.4/4.8	2.7/3.8	2.3/3.6	2.3/3.1	2.4/2.8	2.4/2.8	2.7/3.5	2.7/4.1	2.4/4.4	1.5/3.3	1.3/3.0	2.7/3.1

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	2.4	3.4	4.4	5.9	7.2	7.9	7.8	7.0	5.7	4.1	2.4	1.8	5.0
	Min/Max	1.6/2.8	2.6/4.6	3.8/5.2	4.6/7.2	5.5/9.0	6.5/9.6	6.7/8.8	5.9/8.5	4.6/6.7	3.0/5.3	1.6/2.9	1.2/2.3	4.7/5.6
Latitude -15	Average	2.9	4.0	4.9	6.2	7.3	7.9	7.8	7.3	6.2	4.8	2.9	2.3	5.4
	Min/Max	2.0/3.6	3.0/5.5	4.1/5.8	4.7/7.7	5.6/9.2	6.5/9.6	6.7/8.8	6.2/8.9	4.9/7.4	3.5/6.3	1.9/3.7	1.4/3.0	5.1/6.0
Latitude	Average	3.2	4.3	5.0	6.2	7.1	7.6	7.6	7.1	6.3	4.9	3.1	2.4	5.4
	Min/Max	2.1/3.9	3.1/5.9	4.1/5.9	4.6/7.7	5.4/8.9	6.2/9.2	6.4/8.5	6.0/8.7	4.9/7.5	3.5/6.6	2.0/4.0	1.5/3.3	5.0/6.0
Latitude +15	Average	3.3	4.3	4.9	5.9	6.7	7.1	7.1	6.8	6.1	5.0	3.1	2.5	5.2
	Min/Max	2.2/4.1	3.1/6.0	4.1/5.8	4.4/7.3	5.1/8.4	5.8/8.6	6.0/8.0	5.7/8.3	4.7/7.4	3.5/6.6	2.0/4.1	1.5/3.5	4.9/5.9

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	3.4	4.4	5.0	6.3	7.4	8.1	8.0	7.3	6.3	5.0	3.2	2.6	5.6
	Min/Max	2.2/4.2	3.2/6.0	4.2/5.9	4.7/7.7	5.7/9.3	6.6/9.8	6.8/9.0	6.2/8.9	4.9/7.6	3.5/6.6	2.0/4.2	1.5/3.5	5.2/6.2

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	1.7	2.0	2.1	2.6	3.2	3.6	3.5	3.2	2.9	2.5	1.6	1.2	2.5
	Min/Max	0.9/2.5	1.2/2.8	1.2/2.8	1.5/3.7	1.9/4.7	2.5/5.0	2.5/4.4	2.4/4.3	1.9/3.8	1.4/3.8	0.8/2.4	0.5/2.0	2.2/3.1
1-Axis, N-S Horiz Axis	Average	1.2	1.8	2.3	3.4	4.2	4.7	4.7	4.2	3.4	2.4	1.2	0.8	2.9
	Min/Max	0.6/1.8	1.0/2.5	1.4/3.2	1.9/4.8	2.6/6.2	3.2/6.5	3.4/5.8	3.1/5.7	2.3/4.5	1.4/3.7	0.6/1.8	0.3/1.3	2.5/3.5
1-Axis, N-S Tilt=Latitude	Average	1.8	2.4	2.8	3.6	4.1	4.4	4.5	4.3	3.9	3.1	1.8	1.3	3.2
	Min/Max	1.0/2.7	1.4/3.3	1.6/3.8	2.0/5.1	2.5/6.1	3.0/6.2	3.3/5.5	3.1/5.9	2.6/5.1	1.8/4.8	0.8/2.7	0.5/2.0	2.8/3.9
2-Axis	Average	1.9	2.5	2.8	3.6	4.4	4.8	4.8	4.4	3.9	3.2	1.9	1.4	3.3
	Min/Max	1.0/2.9	1.4/3.4	1.6/3.8	2.1/5.2	2.7/6.4	3.3/6.7	3.5/5.9	3.2/6.1	2.6/5.1	1.8/4.8	0.9/2.8	0.6/2.2	2.9/4.1

Average Climatic Conditions

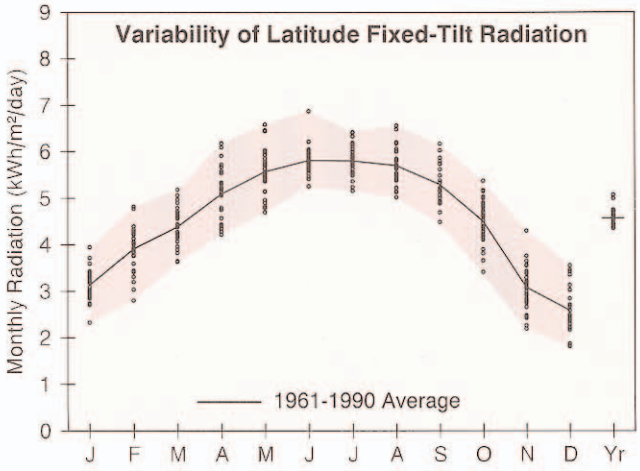
Element	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
Temperature (°C)	-5.1	-3.4	3.1	9.6	15.7	21.2	23.3	22.0	18.3	11.6	5.2	-1.9	9.9
Daily Minimum Temp	-9.3	-7.9	-1.8	3.6	9.5	15.2	17.3	16.1	12.3	5.8	0.8	-5.8	4.7
Daily Maximum Temp	-0.9	1.1	7.9	15.4	21.8	27.2	29.2	27.9	24.2	17.3	9.5	1.9	15.2
Record Minimum Temp	-30.0	-27.8	-23.3	-13.9	-2.8	3.3	6.7	3.3	-1.7	-7.2	-18.3	-27.8	-30.0
Record Maximum Temp	20.6	20.6	27.8	31.1	34.4	41.1	39.4	38.3	37.8	32.2	26.1	21.7	41.1
HDD, Base 18.3°C	725	608	472	263	121	8	0	6	45	216	395	627	3485
CDD, Base 18.3°C	0	0	0	0	38	95	155	119	43	7	0	0	458
Relative Humidity (%)	76	74	72	66	65	66	69	73	73	72	76	79	72
Wind Speed (m/s)	5.3	4.9	5.4	5.1	4.4	4.1	3.6	3.4	3.6	4.1	4.7	5.0	4.5

Indianapolis, IN

WBAN NO. 93819

LATITUDE: 39.73° N
LONGITUDE: 86.28° W
ELEVATION: 246 meters
MEAN PRESSURE: 988 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	2.0	2.8	3.7	4.9	5.9	6.5	6.3	5.6	4.6	3.3	2.1	1.6	4.1
	Min/Max	1.6/2.3	2.3/3.3	3.2/4.1	4.1/5.7	5.1/6.9	5.9/7.7	5.6/7.0	5.0/6.4	4.0/5.2	2.8/3.8	1.7/2.5	1.3/2.0	3.9/4.5
Latitude -15	Average	2.8	3.6	4.3	5.2	5.9	6.3	6.2	5.9	5.2	4.2	2.8	2.3	4.6
	Min/Max	2.2/3.5	2.7/4.4	3.6/5.0	4.3/6.3	5.0/7.0	5.7/7.5	5.6/6.9	5.2/6.8	4.5/6.1	3.3/5.0	2.1/3.8	1.7/3.1	4.4/5.1
Latitude	Average	3.1	3.9	4.4	5.1	5.6	5.8	5.8	5.7	5.3	4.5	3.1	2.6	4.6
	Min/Max	2.3/4.0	2.8/4.8	3.6/5.2	4.2/6.2	4.7/6.6	5.3/6.9	5.2/6.4	5.0/6.6	4.5/6.2	3.4/5.4	2.2/4.3	1.8/3.5	4.3/5.1
Latitude +15	Average	3.3	4.0	4.3	4.7	4.9	5.0	5.1	5.2	5.1	4.5	3.2	2.7	4.3
	Min/Max	2.4/4.3	2.8/5.0	3.5/5.1	3.9/5.7	4.2/5.8	4.6/5.9	4.5/5.6	4.6/5.9	4.3/5.9	3.4/5.4	2.2/4.5	1.9/3.8	4.1/4.8
90	Average	3.0	3.5	3.2	3.0	2.7	2.6	2.7	3.1	3.5	3.6	2.8	2.5	3.0
	Min/Max	2.1/4.1	2.4/4.6	2.5/3.8	2.5/3.6	2.4/3.1	2.4/2.8	2.5/2.9	2.7/3.5	2.9/4.1	2.6/4.4	1.8/4.1	1.6/3.7	2.8/3.3

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	2.7	3.7	4.7	6.2	7.5	8.2	8.1	7.4	6.1	4.5	2.7	2.1	5.3
	Min/Max	2.0/3.4	2.8/4.6	3.8/5.7	4.9/7.9	6.1/9.1	7.2/10.4	6.9/9.2	6.4/8.9	5.1/7.2	3.4/5.4	1.9/3.8	1.5/2.8	5.1/6.1
Latitude -15	Average	3.3	4.3	5.2	6.5	7.6	8.2	8.1	7.7	6.6	5.2	3.3	2.7	5.7
	Min/Max	2.4/4.3	3.1/5.5	4.2/6.3	5.1/8.4	6.1/9.3	7.2/10.4	6.9/9.3	6.6/9.3	5.5/7.9	3.8/6.4	2.2/4.7	1.8/3.7	5.4/6.6
Latitude	Average	3.6	4.6	5.3	6.5	7.4	7.9	7.8	7.5	6.7	5.5	3.5	2.9	5.8
	Min/Max	2.5/4.7	3.2/5.8	4.2/6.4	4.9/8.4	5.9/9.0	6.9/10.0	6.7/9.0	6.4/9.1	5.5/8.0	3.9/6.7	2.3/5.1	1.9/4.1	5.4/6.6
Latitude +15	Average	3.7	4.7	5.2	6.2	6.9	7.3	7.3	7.1	6.5	5.5	3.6	3.0	5.6
	Min/Max	2.6/4.9	3.2/5.9	4.1/6.4	4.7/8.1	5.6/8.5	6.4/9.3	6.2/8.4	6.1/8.7	5.3/7.8	3.9/6.7	2.4/5.3	2.0/4.3	5.3/6.4

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

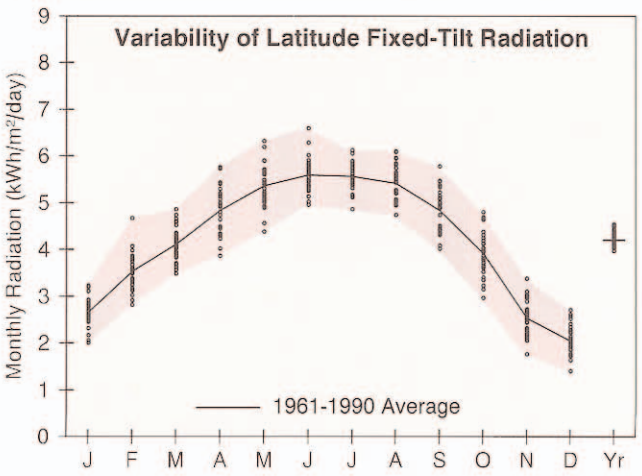
Tracker		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
2-Axis	Average	3.7	4.7	5.3	6.6	7.7	8.4	8.3	7.7	6.7	5.5	3.6	3.1	5.9
	Min/Max	2.6/4.9	3.2/5.9	4.2/6.5	5.1/8.5	6.2/9.4	7.3/10.6	7.1/9.5	6.6/9.4	5.6/8.1	4.0/6.7	2.4/5.3	2.0/4.4	5.6/6.8

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	2.0	2.3	2.3	2.8	3.4	3.7	3.7	3.4	3.1	2.9	1.9	1.6	2.7
	Min/Max	1.1/3.0	1.1/3.4	1.4/3.2	1.7/4.2	2.2/4.8	3.0/5.8	2.7/4.8	2.6/4.7	2.3/4.3	1.6/3.8	0.9/3.3	0.8/2.7	2.5/3.5
1-Axis, N-S Horiz Axis	Average	1.4	2.0	2.5	3.6	4.4	4.9	4.8	4.5	3.8	2.8	1.5	1.1	3.1
	Min/Max	0.8/2.2	1.0/3.1	1.5/3.6	2.1/5.5	2.9/6.4	3.9/7.6	3.6/6.3	3.5/6.3	2.8/5.1	1.6/3.8	0.7/2.6	0.5/1.8	2.8/4.0
1-Axis, N-S Tilt=Latitude	Average	2.1	2.7	3.0	3.8	4.3	4.6	4.6	4.6	4.2	3.6	2.1	1.7	3.4
	Min/Max	1.2/3.3	1.3/4.1	1.8/4.2	2.2/5.8	2.8/6.2	3.6/7.1	3.5/6.1	3.5/6.4	3.1/5.8	2.1/4.8	1.0/3.7	0.8/2.8	3.1/4.4
2-Axis	Average	2.3	2.8	3.0	3.9	4.6	5.0	5.0	4.7	4.2	3.6	2.2	1.8	3.6
	Min/Max	1.3/3.5	1.4/4.2	1.9/4.2	2.3/5.9	3.0/6.6	4.0/7.8	3.7/6.5	3.6/6.7	3.2/5.8	2.1/4.8	1.1/3.9	0.9/3.0	3.2/4.6

Average Climatic Conditions

Element	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
Temperature (°C)	-3.6	-1.3	5.2	11.3	17.1	22.2	24.1	22.9	19.2	12.6	6.1	-0.6	11.3
Daily Minimum Temp	-8.2	-6.2	-0.1	5.3	10.9	16.1	18.4	17.1	13.1	6.4	1.2	-4.9	5.8
Daily Maximum Temp	0.9	3.5	10.5	17.4	23.2	28.2	29.7	28.7	25.3	18.8	11.1	3.6	16.7
Record Minimum Temp	-30.0	-29.4	-21.7	-8.9	-2.2	3.9	6.7	5.0	-2.2	-8.3	-18.9	-30.6	-30.6
Record Maximum Temp	21.7	23.3	29.4	31.7	33.9	38.9	40.0	38.9	37.8	32.2	27.2	23.3	40.0
HDD, Base 18.3°C	681	551	407	210	92	3	0	3	32	188	367	587	3119
CDD, Base 18.3°C	0	0	0	0	53	118	179	144	59	10	0	0	563
Relative Humidity (%)	75	74	70	66	67	68	73	75	74	72	76	78	72
Wind Speed (m/s)	4.7	4.6	5.1	4.7	4.1	3.7	3.3	3.1	3.4	3.8	4.4	4.6	4.1



South Bend, IN

WBAN NO. 14848

LATITUDE: 41.70° N
LONGITUDE: 86.32° W
ELEVATION: 236 meters
MEAN PRESSURE: 988 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	1.7	2.5	3.4	4.6	5.6	6.2	6.0	5.3	4.1	2.9	1.7	1.4	3.8
	Min/Max	1.5/2.0	2.2/3.2	3.0/3.9	3.8/5.3	4.7/6.6	5.5/7.3	5.3/6.6	4.8/5.9	3.6/4.8	2.4/3.3	1.4/2.0	1.1/1.6	3.6/4.1
Latitude -15	Average	2.4	3.3	4.0	5.0	5.7	6.1	6.0	5.6	4.8	3.7	2.3	1.9	4.2
	Min/Max	1.9/2.9	2.7/4.3	3.5/4.7	4.0/5.8	4.7/6.7	5.4/7.2	5.2/6.6	4.9/6.3	4.0/5.7	2.9/4.5	1.7/3.0	1.3/2.4	4.0/4.6
Latitude	Average	2.7	3.5	4.1	4.8	5.4	5.6	5.6	5.4	4.8	3.9	2.5	2.0	4.2
	Min/Max	2.0/3.2	2.8/4.7	3.5/4.9	3.9/5.8	4.4/6.3	4.9/6.6	4.9/6.1	4.7/6.1	4.0/5.8	3.0/4.8	1.8/3.4	1.4/2.7	4.0/4.5
Latitude +15	Average	2.8	3.6	4.0	4.5	4.7	4.8	4.9	4.9	4.6	3.9	2.6	2.1	4.0
	Min/Max	2.0/3.4	2.8/4.9	3.3/4.8	3.5/5.4	3.9/5.6	4.3/5.7	4.3/5.3	4.3/5.6	3.8/5.6	2.9/4.8	1.8/3.5	1.4/2.9	3.7/4.3
90	Average	2.6	3.2	3.1	3.0	2.8	2.6	2.7	3.0	3.3	3.2	2.3	2.0	2.8
	Min/Max	1.8/3.3	2.5/4.5	2.5/3.9	2.4/3.5	2.3/3.1	2.4/2.9	2.4/2.9	2.7/3.4	2.7/4.0	2.3/4.0	1.5/3.2	1.2/2.8	2.6/3.1

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	2.2	3.3	4.3	5.9	7.2	7.9	7.7	6.9	5.5	3.8	2.2	1.7	4.9
	Min/Max	1.6/2.7	2.6/4.3	3.6/5.2	4.5/7.2	5.7/8.9	6.7/9.7	6.7/8.7	5.8/8.0	4.5/6.7	2.9/4.7	1.6/2.9	1.2/2.1	4.6/5.4
Latitude -15	Average	2.7	3.9	4.8	6.2	7.3	7.9	7.8	7.2	6.0	4.5	2.6	2.1	5.3
	Min/Max	2.0/3.3	3.0/5.1	4.0/5.8	4.7/7.7	5.8/9.1	6.6/9.8	6.7/8.8	6.0/8.4	4.9/7.5	3.3/5.6	1.8/3.6	1.4/2.8	4.9/5.9
Latitude	Average	3.0	4.1	4.9	6.1	7.1	7.6	7.5	7.1	6.0	4.7	2.8	2.2	5.3
	Min/Max	2.1/3.6	3.1/5.4	4.0/6.0	4.6/7.6	5.5/8.9	6.3/9.4	6.4/8.5	5.9/8.3	4.9/7.6	3.4/5.9	1.8/3.9	1.5/3.0	4.9/5.9
Latitude +15	Average	3.1	4.1	4.8	5.8	6.6	7.0	7.0	6.7	5.9	4.7	2.9	2.3	5.1
	Min/Max	2.2/3.8	3.2/5.6	3.9/5.9	4.3/7.3	5.2/8.3	5.9/8.8	6.0/8.0	5.6/7.9	4.7/7.4	3.3/5.9	1.8/4.1	1.5/3.2	4.7/5.7

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	3.1	4.2	4.9	6.2	7.4	8.1	7.9	7.3	6.1	4.7	2.9	2.3	5.4
	Min/Max	2.2/3.8	3.2/5.6	4.1/6.0	4.7/7.7	5.8/9.2	6.8/10.0	6.8/9.0	6.1/8.4	4.9/7.6	3.4/5.9	1.9/4.1	1.5/3.3	5.1/6.1

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	1.4	1.8	2.0	2.6	3.2	3.6	3.5	3.2	2.7	2.3	1.4	1.0	2.4
	Min/Max	0.8/2.1	1.1/2.4	1.2/2.7	1.5/3.7	2.1/4.6	2.6/5.1	2.7/4.5	2.3/4.0	1.8/3.8	1.3/3.3	0.6/2.3	0.4/1.8	2.1/3.0
1-Axis, N-S Horiz Axis	Average	0.9	1.5	2.2	3.3	4.2	4.7	4.6	4.1	3.2	2.2	1.0	0.6	2.7
	Min/Max	0.5/1.5	0.9/2.0	1.4/3.0	1.9/4.7	2.8/6.2	3.4/6.7	3.6/5.9	3.0/5.3	2.2/4.6	1.2/3.2	0.4/1.7	0.3/1.2	2.4/3.4
1-Axis, N-S Tilt=Latitude	Average	1.5	2.1	2.6	3.5	4.2	4.5	4.4	4.2	3.7	2.9	1.5	1.0	3.0
	Min/Max	0.9/2.3	1.3/2.9	1.6/3.6	2.0/5.1	2.8/6.1	3.2/6.3	3.5/5.6	3.0/5.4	2.4/5.3	1.6/4.1	0.7/2.6	0.5/1.9	2.6/3.7
2-Axis	Average	1.6	2.2	2.6	3.6	4.4	4.8	4.8	4.4	3.7	2.9	1.6	1.1	3.1
	Min/Max	0.9/2.5	1.3/2.9	1.6/3.6	2.1/5.1	2.9/6.4	3.5/6.9	3.7/6.1	3.1/5.6	2.5/5.3	1.6/4.2	0.7/2.7	0.5/2.1	2.7/3.9

Average Climatic Conditions

Element	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
Temperature (°C)	-4.8	-3.1	3.0	9.3	15.2	20.6	22.7	21.6	17.7	11.4	4.9	-1.7	9.7
Daily Minimum Temp	-8.8	-7.4	-1.6	3.7	9.3	14.8	17.2	16.2	12.1	6.0	0.8	-5.4	4.7
Daily Maximum Temp	-0.9	1.2	7.6	14.8	21.1	26.4	28.3	27.1	23.4	16.8	9.2	1.9	14.7
Record Minimum Temp	-30.0	-27.2	-25.0	-11.7	-4.4	1.7	6.7	4.4	-1.7	-6.7	-21.7	-26.7	-30.0
Record Maximum Temp	20.0	20.6	29.4	32.8	35.0	40.0	38.3	39.4	37.2	33.3	27.8	21.1	40.0
HDD, Base 18.3°C	718	601	476	272	129	16	4	12	47	219	402	622	3517
CDD, Base 18.3°C	0	0	0	0	33	84	139	114	29	6	0	0	404
Relative Humidity (%)	77	75	71	66	66	67	70	73	74	72	76	79	72
Wind Speed (m/s)	5.3	5.0	5.3	5.1	4.4	4.0	3.6	3.4	3.7	4.2	4.8	5.1	4.5