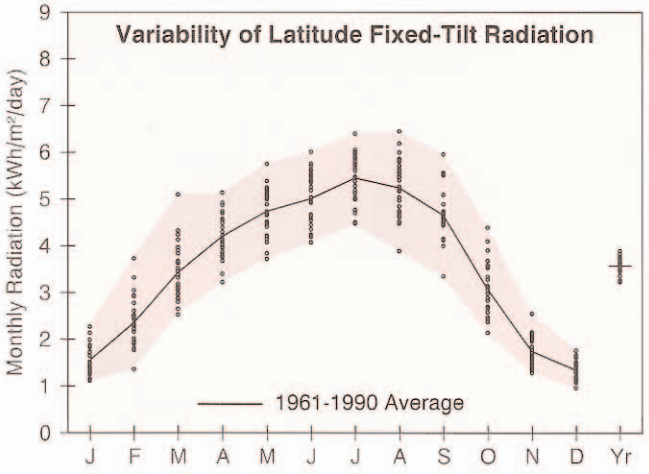


Olympia, WA

WBAN NO. 24227

LATITUDE: 46.97° N
LONGITUDE: 122.90° W
ELEVATION: 61 meters
MEAN PRESSURE: 1010 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	1.0	1.7	2.8	4.0	5.0	5.6	5.9	5.1	3.8	2.2	1.2	0.9	3.3
	Min/Max	0.8/1.3	1.3/2.2	2.3/3.6	3.2/4.6	4.1/5.9	4.6/6.6	4.9/6.9	4.0/6.0	3.0/4.6	1.9/2.8	1.0/1.5	0.8/1.0	3.0/3.5
Latitude -15	Average	1.4	2.3	3.4	4.4	5.1	5.5	5.9	5.5	4.6	3.0	1.6	1.2	3.7
	Min/Max	1.1/2.1	1.4/3.4	2.5/4.9	3.4/5.3	4.0/6.1	4.4/6.5	4.8/6.9	4.1/6.7	3.4/5.9	2.1/4.1	1.2/2.3	0.9/1.6	3.3/4.0
Latitude	Average	1.5	2.4	3.4	4.2	4.7	5.0	5.5	5.2	4.6	3.1	1.7	1.3	3.6
	Min/Max	1.1/2.3	1.4/3.7	2.5/5.1	3.2/5.1	3.7/5.8	4.1/6.0	4.5/6.4	3.9/6.4	3.3/6.0	2.1/4.4	1.3/2.5	1.0/1.8	3.2/3.9
Latitude +15	Average	1.6	2.4	3.3	3.9	4.2	4.3	4.8	4.7	4.4	3.0	1.8	1.4	3.3
	Min/Max	1.1/2.4	1.3/3.8	2.4/5.0	2.9/4.8	3.3/5.1	3.5/5.2	3.9/5.6	3.5/5.8	3.1/5.7	2.0/4.4	1.3/2.6	0.9/1.8	3.0/3.6
90	Average	1.4	2.0	2.6	2.8	2.8	2.7	3.0	3.2	3.4	2.6	1.6	1.3	2.4
	Min/Max	1.0/2.2	1.1/3.4	1.9/4.1	2.1/3.4	2.2/3.3	2.3/3.1	2.6/3.4	2.5/4.0	2.4/4.4	1.7/3.8	1.1/2.4	0.8/1.7	2.2/2.7

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	1.2	2.1	3.5	5.0	6.3	7.1	7.7	6.7	5.2	2.9	1.4	1.0	4.2
	Min/Max	0.9/1.8	1.3/3.2	2.6/5.1	3.6/6.1	4.7/7.9	5.3/8.8	5.8/9.5	4.5/8.4	3.6/7.0	2.1/4.1	1.1/2.0	0.8/1.3	3.7/4.6
Latitude -15	Average	1.6	2.5	4.0	5.3	6.5	7.1	7.9	7.1	5.8	3.5	1.8	1.3	4.5
	Min/Max	1.1/2.3	1.4/4.1	2.8/6.1	3.8/6.6	4.7/8.2	5.2/8.9	5.8/9.7	4.7/9.1	3.9/8.0	2.3/5.1	1.3/2.7	0.9/1.7	4.0/5.0
Latitude	Average	1.7	2.6	4.1	5.2	6.2	6.8	7.6	7.0	5.9	3.6	1.9	1.4	4.5
	Min/Max	1.1/2.5	1.4/4.3	2.8/6.3	3.7/6.6	4.5/7.9	5.0/8.6	5.6/9.4	4.5/8.9	3.8/8.1	2.3/5.3	1.4/2.8	1.0/1.9	4.0/5.0
Latitude +15	Average	1.7	2.6	4.0	5.0	5.9	6.3	7.1	6.6	5.7	3.5	1.9	1.4	4.3
	Min/Max	1.1/2.6	1.4/4.4	2.8/6.2	3.5/6.3	4.2/7.5	4.6/8.0	5.2/8.8	4.3/8.5	3.7/7.9	2.2/5.3	1.4/2.9	1.0/2.0	3.8/4.8

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	1.7	2.7	4.1	5.3	6.6	7.3	8.0	7.2	5.9	3.6	1.9	1.5	4.7
	Min/Max	1.1/2.7	1.4/4.4	2.9/6.3	3.8/6.7	4.8/8.3	5.4/9.1	5.9/9.9	4.7/9.1	3.9/8.1	2.3/5.4	1.4/2.9	1.0/2.0	4.1/5.1

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	0.7	1.1	1.7	2.0	2.5	3.0	3.7	3.3	2.8	1.7	0.8	0.6	2.0
	Min/Max	0.2/1.4	0.3/2.6	0.8/3.3	1.0/2.9	1.3/3.8	1.5/4.5	2.1/5.2	1.4/4.7	1.2/4.5	0.6/3.0	0.5/1.5	0.3/1.0	1.6/2.4
1-Axis, N-S Horiz Axis	Average	0.4	0.9	1.8	2.5	3.3	3.9	4.8	4.2	3.2	1.5	0.6	0.4	2.3
	Min/Max	0.1/0.9	0.3/2.0	0.9/3.3	1.2/3.6	1.7/4.9	2.0/5.8	2.6/6.8	1.7/6.0	1.4/5.3	0.6/2.7	0.3/1.0	0.2/0.6	1.8/2.8
1-Axis, N-S Tilt=Latitude	Average	0.8	1.3	2.2	2.7	3.3	3.8	4.7	4.4	3.8	2.1	0.9	0.7	2.6
	Min/Max	0.2/1.5	0.4/3.0	1.1/4.3	1.3/3.9	1.7/4.9	1.9/5.6	2.6/6.7	1.9/6.3	1.6/6.3	0.8/3.7	0.5/1.6	0.3/1.0	2.1/3.1
2-Axis	Average	0.8	1.4	2.2	2.8	3.5	4.1	5.0	4.6	3.8	2.1	1.0	0.7	2.7
	Min/Max	0.2/1.6	0.4/3.1	1.1/4.3	1.4/4.0	1.8/5.2	2.1/6.1	2.8/7.2	1.9/6.5	1.6/6.3	0.8/3.8	0.5/1.7	0.3/1.1	2.1/3.2

Average Climatic Conditions

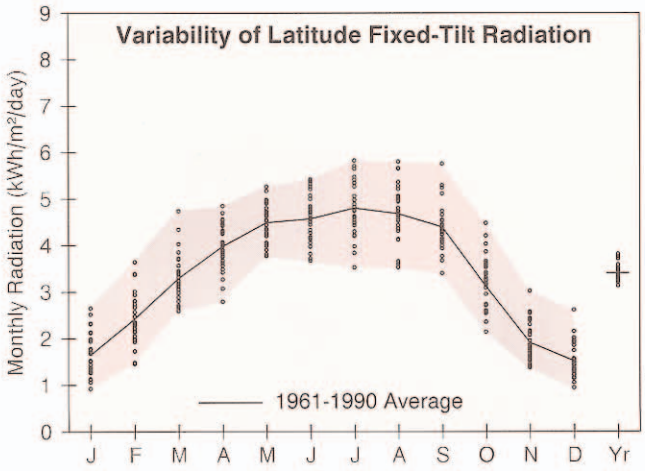
Element	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
Temperature (°C)	3.3	5.1	6.6	8.6	11.8	14.8	17.2	17.4	14.4	9.8	5.8	3.4	9.8
Daily Minimum Temp	-0.2	0.4	0.9	2.3	5.0	8.0	9.6	9.7	7.1	3.8	1.7	0.1	4.0
Daily Maximum Temp	6.9	9.7	12.2	14.9	18.5	21.6	24.7	25.1	21.7	15.8	10.0	6.8	15.7
Record Minimum Temp	-22.2	-18.3	-12.8	-5.0	-3.9	-1.1	1.7	0.6	-3.9	-6.7	-18.3	-21.7	-22.2
Record Maximum Temp	17.2	22.8	24.4	30.6	35.6	38.3	39.4	40.0	36.7	32.2	23.3	17.8	40.0
HDD, Base 18.3°C	465	372	365	292	203	112	53	57	123	263	375	462	3142
CDD, Base 18.3°C	0	0	0	0	0	7	17	27	5	0	0	0	56
Relative Humidity (%)	88	85	80	75	73	72	71	72	78	85	88	89	80
Wind Speed (m/s)	3.3	3.2	3.3	3.4	3.3	3.1	2.9	2.8	2.7	2.7	3.3	3.1	3.1

Quillayute, WA

WBAN NO. 94240

LATITUDE: 47.95° N
LONGITUDE: 124.55° W
ELEVATION: 55 meters
MEAN PRESSURE: 1010 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	1.0	1.6	2.6	3.7	4.7	5.1	5.2	4.5	3.5	2.1	1.2	0.8	3.0
	Min/Max	0.7/1.3	1.2/2.0	2.2/3.3	2.8/4.3	4.1/5.4	4.2/5.9	4.0/6.2	3.6/5.4	3.0/4.4	1.7/2.7	1.0/1.5	0.7/1.1	2.8/3.2
Latitude -15	Average	1.5	2.3	3.2	4.1	4.8	5.0	5.2	4.9	4.4	3.0	1.8	1.4	3.5
	Min/Max	0.9/2.3	1.4/3.3	2.6/4.6	2.9/5.0	4.1/5.6	4.0/5.9	3.8/6.3	3.7/6.0	3.5/5.7	2.1/4.2	1.3/2.7	0.9/2.3	3.2/3.8
Latitude	Average	1.6	2.4	3.3	4.0	4.5	4.6	4.8	4.7	4.4	3.1	1.9	1.5	3.4
	Min/Max	0.9/2.7	1.5/3.6	2.6/4.7	2.8/4.8	3.8/5.3	3.7/5.4	3.5/5.8	3.5/5.8	3.4/5.8	2.1/4.5	1.4/3.0	0.9/2.6	3.1/3.8
Latitude +15	Average	1.7	2.4	3.2	3.7	4.0	4.0	4.2	4.2	4.2	3.1	2.0	1.6	3.2
	Min/Max	0.9/2.8	1.4/3.7	2.5/4.7	2.5/4.5	3.3/4.6	3.2/4.7	3.1/5.1	3.2/5.3	3.2/5.5	2.1/4.5	1.4/3.2	0.9/2.8	2.9/3.6
90	Average	1.6	2.1	2.6	2.7	2.7	2.5	2.7	3.0	3.2	2.6	1.8	1.5	2.4
	Min/Max	0.8/2.7	1.2/3.4	2.0/3.9	1.9/3.3	2.3/3.0	2.1/2.9	2.1/3.2	2.3/3.6	2.5/4.3	1.7/3.9	1.2/3.0	0.8/2.7	2.2/2.8

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	1.3	2.1	3.4	4.7	5.9	6.3	6.5	5.8	4.9	2.9	1.5	1.1	3.9
	Min/Max	0.8/1.9	1.3/3.1	2.6/4.8	3.1/5.9	4.9/7.2	4.9/7.6	4.6/8.3	4.2/7.4	3.7/6.7	2.0/4.2	1.2/2.3	0.8/1.7	3.5/4.3
Latitude -15	Average	1.7	2.7	3.9	5.1	6.0	6.3	6.6	6.2	5.5	3.6	2.0	1.5	4.3
	Min/Max	0.9/2.7	1.5/4.1	3.0/5.7	3.2/6.4	4.9/7.5	4.8/7.8	4.6/8.5	4.3/8.0	4.1/7.7	2.3/5.3	1.4/3.2	0.9/2.6	3.9/4.8
Latitude	Average	1.8	2.8	4.0	5.0	5.8	6.0	6.4	6.1	5.6	3.7	2.1	1.6	4.2
	Min/Max	0.9/3.0	1.5/4.3	3.0/5.9	3.2/6.3	4.7/7.3	4.6/7.4	4.4/8.2	4.2/7.9	4.0/7.8	2.4/5.5	1.5/3.5	1.0/2.9	3.8/4.9
Latitude +15	Average	1.8	2.8	3.9	4.7	5.5	5.6	6.0	5.7	5.4	3.7	2.2	1.7	4.1
	Min/Max	0.9/3.1	1.5/4.4	2.9/5.8	3.0/6.1	4.4/6.8	4.2/6.9	4.1/7.7	4.0/7.5	3.9/7.6	2.3/5.5	1.5/3.6	1.0/3.1	3.7/4.7

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

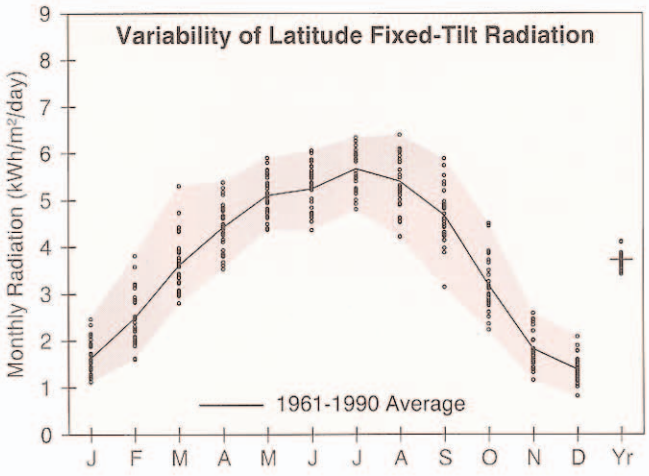
Tracker		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
2-Axis	Average	1.9	2.8	4.0	5.1	6.1	6.5	6.8	6.2	5.6	3.7	2.2	1.7	4.4
	Min/Max	0.9/3.2	1.5/4.4	3.0/5.9	3.3/6.4	5.0/7.6	4.9/7.9	4.7/8.7	4.4/8.1	4.1/7.8	2.4/5.6	1.5/3.6	1.0/3.2	4.0/5.0

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	0.9	1.4	1.7	2.0	2.5	2.7	3.0	2.8	2.7	1.9	1.1	0.9	2.0
	Min/Max	0.3/2.0	0.5/2.8	0.9/3.2	0.9/3.1	1.5/3.7	1.2/3.9	1.5/4.5	1.3/4.2	1.5/4.4	0.8/3.3	0.5/2.3	0.3/2.2	1.7/2.5
1-Axis, N-S Horiz Axis	Average	0.6	1.1	1.8	2.5	3.2	3.4	3.8	3.5	3.1	1.7	0.7	0.5	2.2
	Min/Max	0.2/1.2	0.4/2.2	1.0/3.2	1.1/3.9	2.0/4.8	1.7/5.0	2.0/5.9	1.6/5.3	1.7/5.1	0.7/3.0	0.3/1.5	0.2/1.2	1.9/2.7
1-Axis, N-S Tilt=Latitude	Average	1.0	1.6	2.3	2.8	3.2	3.3	3.8	3.7	3.7	2.4	1.2	1.0	2.5
	Min/Max	0.3/2.2	0.6/3.3	1.3/4.2	1.2/4.3	1.9/4.8	1.6/4.8	1.9/5.8	1.8/5.6	2.0/6.1	1.0/4.2	0.6/2.5	0.3/2.2	2.2/3.2
2-Axis	Average	1.1	1.7	2.3	2.8	3.4	3.6	4.0	3.8	3.7	2.4	1.3	1.0	2.6
	Min/Max	0.3/2.3	0.6/3.4	1.3/4.2	1.2/4.3	2.1/5.0	1.8/5.2	2.1/6.2	1.8/5.8	2.0/6.1	1.0/4.2	0.6/2.7	0.3/2.4	2.3/3.3

Average Climatic Conditions

Element	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
Temperature (°C)	4.4	5.6	6.3	7.9	10.5	13.0	14.9	15.2	13.7	10.2	6.7	4.6	9.4
Daily Minimum Temp	0.9	1.6	1.8	2.9	5.4	8.1	9.7	9.8	7.9	5.2	2.9	1.3	4.8
Daily Maximum Temp	7.8	9.5	10.8	12.8	15.5	17.9	20.1	20.6	19.4	15.2	10.5	7.9	14.0
Record Minimum Temp	-13.9	-11.7	-7.2	-4.4	-1.7	0.6	3.3	2.2	-2.2	-4.4	-15.0	-13.9	-15.0
Record Maximum Temp	18.3	22.2	21.7	28.3	33.3	35.6	36.1	37.2	36.1	28.3	20.6	17.8	37.2
HDD, Base 18.3°C	432	358	374	313	243	160	107	100	142	252	348	426	3254
CDD, Base 18.3°C	0	0	0	0	0	0	0	3	0	0	0	0	3
Relative Humidity (%)	87	85	83	81	81	82	82	84	83	87	88	89	84
Wind Speed (m/s)	4.6	4.3	4.1	3.7	3.4	3.2	3.1	2.8	3.0	3.6	4.2	4.2	3.7



Seattle, WA

WBAN NO. 24233

LATITUDE: 47.45° N
LONGITUDE: 122.30° W
ELEVATION: 122 meters
MEAN PRESSURE: 1001 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	1.0	1.7	2.8	4.1	5.3	5.8	6.1	5.2	3.8	2.2	1.2	0.8	3.3
	Min/Max	0.8/1.2	1.2/2.1	2.4/3.6	3.5/4.8	4.6/6.1	4.8/6.7	5.2/6.7	4.2/5.9	2.9/4.5	1.8/2.8	0.9/1.4	0.6/1.0	3.2/3.6
Latitude -15	Average	1.5	2.3	3.5	4.6	5.4	5.7	6.1	5.6	4.7	3.0	1.7	1.3	3.8
	Min/Max	1.1/2.2	1.5/3.5	2.8/5.1	3.7/5.5	4.7/6.3	4.7/6.6	5.2/6.8	4.4/6.6	3.2/5.8	2.2/4.2	1.1/2.3	0.8/1.8	3.5/4.2
Latitude	Average	1.6	2.5	3.6	4.4	5.1	5.2	5.7	5.4	4.7	3.2	1.8	1.4	3.7
	Min/Max	1.1/2.5	1.6/3.8	2.8/5.3	3.5/5.4	4.4/5.9	4.4/6.1	4.8/6.3	4.2/6.4	3.1/5.9	2.2/4.5	1.1/2.6	0.8/2.1	3.4/4.1
Latitude +15	Average	1.7	2.5	3.5	4.1	4.5	4.5	4.9	4.9	4.5	3.2	1.8	1.4	3.5
	Min/Max	1.1/2.6	1.6/3.9	2.7/5.2	3.2/5.0	3.9/5.2	3.8/5.2	4.2/5.5	3.8/5.8	3.0/5.7	2.2/4.5	1.1/2.7	0.8/2.2	3.2/3.8
90	Average	1.5	2.2	2.8	3.0	3.0	2.8	3.1	3.4	3.4	2.7	1.7	1.3	2.6
	Min/Max	1.0/2.5	1.4/3.5	2.2/4.3	2.3/3.6	2.6/3.3	2.4/3.2	2.8/3.4	2.7/4.0	2.3/4.4	1.8/3.9	1.0/2.5	0.7/2.1	2.3/2.9

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	1.2	2.2	3.7	5.2	6.7	7.3	8.0	6.9	5.1	3.0	1.5	1.0	4.3
	Min/Max	0.9/1.8	1.5/3.3	2.9/5.4	4.1/6.3	5.3/8.2	5.8/9.1	6.1/9.0	5.0/8.4	3.4/6.6	2.1/4.2	0.9/2.0	0.7/1.4	3.8/4.8
Latitude -15	Average	1.6	2.7	4.2	5.6	6.9	7.3	8.2	7.3	5.8	3.6	1.9	1.4	4.7
	Min/Max	1.1/2.5	1.7/4.3	3.2/6.5	4.3/7.0	5.3/8.6	5.8/9.3	6.2/9.2	5.3/9.0	3.7/7.6	2.5/5.2	1.1/2.7	0.8/2.1	4.1/5.3
Latitude	Average	1.8	2.8	4.3	5.5	6.7	7.0	7.9	7.2	5.9	3.7	2.0	1.5	4.7
	Min/Max	1.2/2.8	1.8/4.6	3.3/6.7	4.2/6.9	5.1/8.3	5.5/8.9	5.9/8.9	5.2/8.8	3.7/7.7	2.5/5.5	1.1/2.9	0.8/2.3	4.1/5.3
Latitude +15	Average	1.8	2.8	4.2	5.3	6.3	6.6	7.4	6.8	5.7	3.7	2.0	1.5	4.5
	Min/Max	1.2/2.9	1.7/4.6	3.2/6.6	4.0/6.6	4.7/7.8	5.1/8.3	5.5/8.4	4.9/8.4	3.6/7.5	2.4/5.5	1.1/3.0	0.8/2.4	3.9/5.1

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	1.8	2.9	4.3	5.6	7.0	7.5	8.3	7.4	5.9	3.7	2.0	1.5	4.9
	Min/Max	1.2/2.9	1.8/4.7	3.3/6.7	4.3/7.0	5.4/8.7	5.9/9.5	6.3/9.4	5.3/9.0	3.8/7.7	2.5/5.5	1.1/3.0	0.8/2.4	4.2/5.5

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	0.9	1.4	1.9	2.3	3.0	3.3	4.0	3.5	2.9	1.8	1.0	0.8	2.2
	Min/Max	0.4/1.8	0.6/2.9	1.2/3.8	1.3/3.3	1.5/4.3	1.7/4.9	2.3/5.1	2.0/4.7	1.4/4.2	1.0/3.2	0.3/1.7	0.3/1.5	1.6/2.6
1-Axis, N-S Horiz Axis	Average	0.5	1.1	1.9	2.8	3.8	4.2	5.2	4.4	3.2	1.6	0.6	0.4	2.5
	Min/Max	0.2/1.1	0.5/2.3	1.1/3.8	1.6/4.0	1.7/5.7	2.1/6.4	2.8/6.5	2.4/5.9	1.6/4.8	0.7/2.8	0.2/1.2	0.2/0.8	1.8/3.0
1-Axis, N-S Tilt=Latitude	Average	0.9	1.6	2.5	3.1	3.9	4.1	5.1	4.7	3.9	2.2	1.1	0.8	2.8
	Min/Max	0.4/2.0	0.7/3.4	1.4/4.9	1.8/4.4	1.7/5.7	2.0/6.2	2.8/6.4	2.6/6.3	1.9/5.7	1.1/3.9	0.3/1.9	0.3/1.5	2.0/3.3
2-Axis	Average	1.0	1.7	2.5	3.1	4.1	4.4	5.5	4.8	3.9	2.3	1.1	0.9	2.9
	Min/Max	0.4/2.1	0.7/3.5	1.5/4.9	1.8/4.5	1.8/6.0	2.2/6.7	3.0/6.9	2.7/6.5	1.9/5.7	1.1/4.0	0.3/2.0	0.3/1.6	2.1/3.5

Average Climatic Conditions

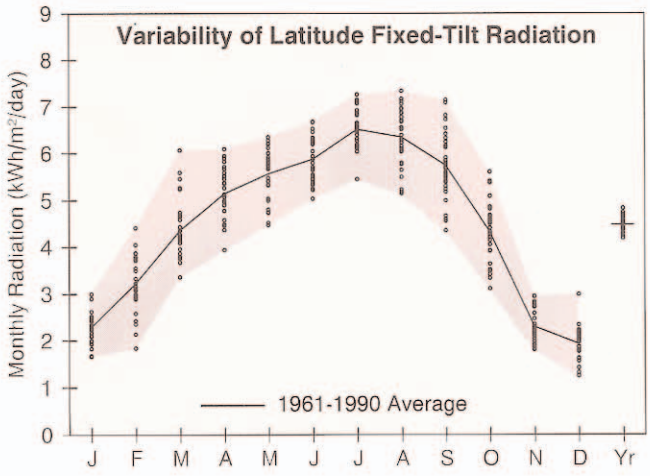
Element	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
Temperature (°C)	4.5	6.4	7.6	9.6	12.8	16.1	18.4	18.6	15.9	11.6	7.4	4.7	11.1
Daily Minimum Temp	1.8	3.0	3.6	5.1	7.9	11.1	12.9	13.2	11.1	7.7	4.5	2.1	7.0
Daily Maximum Temp	7.2	9.7	11.5	14.0	17.7	21.1	24.0	24.0	20.7	15.4	10.3	7.3	15.2
Record Minimum Temp	-17.8	-17.2	-11.7	-1.7	-2.2	3.3	6.1	6.7	1.7	-2.2	-14.4	-14.4	-17.8
Record Maximum Temp	17.8	21.1	23.9	29.4	33.9	35.6	37.2	37.2	36.7	31.7	23.3	17.2	37.2
HDD, Base 18.3°C	429	334	334	263	171	80	32	36	87	210	328	422	2727
CDD, Base 18.3°C	0	0	0	0	0	12	36	45	13	0	0	0	106
Relative Humidity (%)	78	75	74	71	69	67	66	68	73	79	80	80	73
Wind Speed (m/s)	4.1	4.0	4.0	4.0	3.7	3.7	3.5	3.4	3.4	3.5	4.0	4.0	3.8

Spokane, WA

WBAN NO. 24157

LATITUDE: 47.63° N
LONGITUDE: 117.53° W
ELEVATION: 721 meters
MEAN PRESSURE: 932 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	1.3	2.0	3.2	4.6	5.8	6.5	7.0	5.9	4.4	2.7	1.4	1.1	3.8
	Min/Max	1.0/1.6	1.5/2.5	2.7/4.2	3.8/5.3	4.8/6.5	5.7/7.4	5.9/7.7	5.0/6.8	3.7/5.2	2.2/3.2	1.2/1.6	0.8/1.4	3.7/4.1
Latitude -15	Average	2.1	3.0	4.2	5.3	6.0	6.4	7.0	6.6	5.7	4.0	2.1	1.7	4.5
	Min/Max	1.5/2.7	1.8/4.0	3.3/5.8	4.1/6.2	4.8/6.8	5.5/7.3	5.9/7.8	5.4/7.6	4.4/7.0	3.0/5.2	1.7/2.7	1.2/2.6	4.3/4.9
Latitude	Average	2.3	3.2	4.4	5.2	5.6	5.9	6.5	6.3	5.7	4.3	2.3	1.9	4.5
	Min/Max	1.7/3.0	1.8/4.4	3.4/6.1	3.9/6.1	4.5/6.3	5.0/6.7	5.4/7.3	5.2/7.3	4.4/7.1	3.1/5.6	1.8/3.0	1.3/3.0	4.2/4.8
Latitude +15	Average	2.4	3.3	4.3	4.8	4.9	5.1	5.6	5.7	5.5	4.4	2.4	2.0	4.2
	Min/Max	1.7/3.2	1.8/4.6	3.2/6.1	3.6/5.6	3.9/5.6	4.3/5.7	4.7/6.3	4.6/6.6	4.1/6.9	3.1/5.7	1.9/3.1	1.3/3.2	3.9/4.5
90	Average	2.3	3.0	3.5	3.4	3.2	3.1	3.5	3.9	4.3	3.8	2.2	2.0	3.2
	Min/Max	1.6/3.1	1.5/4.2	2.6/5.3	2.6/4.1	2.6/3.6	2.7/3.4	3.0/3.8	3.2/4.5	3.1/5.4	2.6/5.0	1.7/2.9	1.2/3.2	2.9/3.5

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	1.8	2.8	4.6	6.4	7.9	8.9	10.0	8.7	6.6	4.1	1.9	1.4	5.4
	Min/Max	1.3/2.3	1.7/3.8	3.5/6.5	4.8/7.7	6.3/9.2	7.5/10.8	7.9/11.3	6.8/10.4	5.2/8.5	2.9/5.3	1.5/2.4	1.0/2.1	5.1/5.9
Latitude -15	Average	2.4	3.6	5.4	7.0	8.2	9.1	10.2	9.3	7.6	5.1	2.4	1.9	6.0
	Min/Max	1.6/3.1	1.9/5.0	4.0/7.7	5.1/8.4	6.4/9.5	7.6/10.9	8.0/11.6	7.2/11.2	5.7/9.9	3.5/6.8	1.9/3.2	1.2/3.0	5.6/6.5
Latitude	Average	2.5	3.7	5.5	6.9	8.0	8.7	9.9	9.2	7.7	5.3	2.6	2.1	6.0
	Min/Max	1.8/3.4	2.0/5.3	4.0/7.9	5.1/8.4	6.2/9.3	7.3/10.5	7.8/11.2	7.1/11.1	5.7/10.0	3.6/7.1	2.0/3.4	1.3/3.4	5.6/6.5
Latitude +15	Average	2.6	3.8	5.4	6.6	7.5	8.2	9.3	8.7	7.5	5.3	2.6	2.2	5.8
	Min/Max	1.8/3.5	2.0/5.4	3.9/7.9	4.8/8.1	5.8/8.8	6.8/9.9	7.3/10.6	6.7/10.6	5.5/9.8	3.6/7.2	2.0/3.5	1.4/3.6	5.4/6.3

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

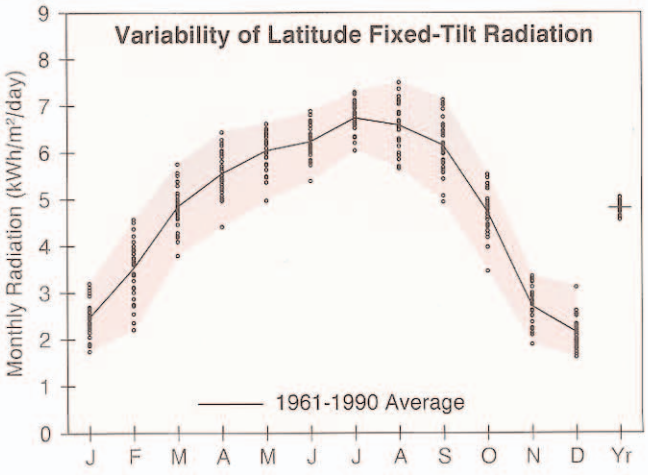
Tracker		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
2-Axis	Average	2.7	3.8	5.5	7.0	8.3	9.3	10.4	9.4	7.7	5.4	2.7	2.2	6.2
	Min/Max	1.8/3.6	2.0/5.4	4.1/7.9	5.2/8.5	6.5/9.7	7.8/11.2	8.2/11.9	7.3/11.3	5.7/10.0	3.7/7.2	2.0/3.5	1.4/3.6	5.7/6.7

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	Average	1.2	1.8	2.6	3.1	3.8	4.5	5.5	4.9	4.1	3.0	1.3	1.0	3.1
Horiz Axis	Min/Max	0.4/2.1	0.6/3.4	1.7/3.9	1.8/4.3	2.4/4.9	3.3/6.2	3.8/6.7	3.3/6.4	2.5/5.9	1.7/4.5	0.8/2.0	0.4/2.0	2.7/3.5
1-Axis, N-S	Average	0.7	1.5	2.8	4.0	5.1	6.0	7.4	6.5	4.9	2.8	0.9	0.6	3.6
Horiz Axis	Min/Max	0.2/1.3	0.5/2.7	1.7/4.2	2.4/5.4	3.3/6.7	4.5/8.3	5.0/8.9	4.4/8.6	3.1/7.1	1.5/4.2	0.5/1.4	0.3/1.1	3.1/4.0
1-Axis, N-S	Average	1.3	2.2	3.5	4.4	5.2	5.8	7.3	6.8	5.7	3.8	1.5	1.1	4.0
Tilt=Latitude	Min/Max	0.4/2.3	0.7/4.0	2.2/5.3	2.6/5.9	3.3/6.7	4.3/8.0	4.9/8.7	4.6/9.0	3.6/8.4	2.1/5.7	0.8/2.2	0.5/2.0	3.5/4.6
2-Axis	Average	1.4	2.2	3.5	4.5	5.5	6.3	7.8	7.0	5.8	3.9	1.6	1.1	4.2
	Min/Max	0.4/2.5	0.7/4.1	2.2/5.3	2.7/6.1	3.5/7.1	4.7/8.7	5.3/9.3	4.7/9.3	3.6/8.4	2.1/5.8	0.9/2.3	0.5/2.2	3.7/4.7

Average Climatic Conditions

Element	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
Temperature (°C)	-2.7	0.7	3.7	7.7	12.2	16.7	20.4	20.2	14.9	8.5	1.7	-2.3	8.5
Daily Minimum Temp	-6.2	-3.4	-1.3	1.5	5.5	9.6	12.4	12.4	7.7	2.2	-1.8	-5.7	2.7
Daily Maximum Temp	0.7	4.8	8.7	13.9	18.8	23.7	28.4	28.1	22.2	14.8	5.2	1.0	14.2
Record Minimum Temp	-30.0	-27.2	-21.7	-8.3	-4.4	0.6	2.8	1.7	-4.4	-12.2	-29.4	-31.7	-31.7
Record Maximum Temp	15.0	16.1	21.7	32.2	35.6	37.8	39.4	42.2	36.7	30.0	19.4	13.3	42.2
HDD, Base 18.3°C	653	493	453	318	191	77	17	31	124	305	498	641	3801
CDD, Base 18.3°C	0	0	0	0	0	27	82	89	22	0	0	0	221
Relative Humidity (%)	83	79	70	61	58	54	44	45	54	67	83	85	65
Wind Speed (m/s)	4.2	4.3	4.5	4.7	4.4	4.3	4.1	3.8	3.9	3.8	4.2	3.7	4.2



Yakima, WA

WBAN NO. 24243

LATITUDE: 46.57° N
LONGITUDE: 120.53° W
ELEVATION: 325 meters
MEAN PRESSURE: 978 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	1.4	2.2	3.6	5.0	6.2	6.9	7.2	6.2	4.7	3.0	1.6	1.1	4.1
	Min/Max	1.2/1.6	1.7/2.5	3.0/4.1	4.1/5.6	5.3/6.8	6.0/7.7	6.5/7.8	5.4/6.9	4.0/5.3	2.5/3.3	1.3/1.8	1.0/1.3	4.0/4.3
Latitude -15	Average	2.2	3.3	4.7	5.7	6.4	6.8	7.3	6.8	6.0	4.4	2.5	1.9	4.8
	Min/Max	1.6/2.8	2.1/4.2	3.7/5.5	4.5/6.5	5.3/7.1	5.9/7.5	6.5/7.9	5.9/7.8	4.9/7.0	3.3/5.1	1.8/3.0	1.5/2.7	4.6/5.1
Latitude	Average	2.5	3.5	4.8	5.5	6.0	6.2	6.7	6.6	6.1	4.7	2.7	2.2	4.8
	Min/Max	1.7/3.2	2.2/4.6	3.8/5.8	4.4/6.4	5.0/6.6	5.4/6.9	6.0/7.3	5.7/7.5	4.9/7.1	3.5/5.5	1.9/3.3	1.6/3.1	4.6/5.0
Latitude +15	Average	2.6	3.6	4.7	5.1	5.3	5.3	5.8	5.9	5.9	4.8	2.8	2.3	4.5
	Min/Max	1.8/3.4	2.2/4.7	3.7/5.7	4.1/6.0	4.4/5.8	4.7/5.9	5.3/6.3	5.1/6.8	4.7/6.9	3.4/5.6	1.9/3.5	1.7/3.3	4.3/4.7
90	Average	2.5	3.2	3.8	3.7	3.4	3.2	3.5	4.0	4.5	4.1	2.6	2.2	3.4
	Min/Max	1.6/3.3	1.9/4.2	3.0/4.6	2.9/4.3	2.8/3.6	2.8/3.4	3.2/3.7	3.4/4.5	3.6/5.3	2.9/4.8	1.7/3.3	1.5/3.2	3.1/3.6

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	1.9	3.1	5.1	6.9	8.6	9.5	10.3	9.0	7.1	4.5	2.2	1.6	5.8
	Min/Max	1.4/2.4	1.9/4.0	4.0/6.0	5.3/8.0	6.9/9.7	7.9/11.0	8.9/11.5	7.6/10.6	5.5/8.4	3.2/5.4	1.6/2.7	1.3/2.2	5.4/6.2
Latitude -15	Average	2.5	3.9	5.9	7.5	8.9	9.6	10.5	9.6	8.2	5.6	2.9	2.2	6.5
	Min/Max	1.8/3.4	2.3/5.2	4.6/7.2	5.7/8.8	7.1/10.0	7.9/11.2	9.1/11.8	8.1/11.4	6.2/9.7	3.9/6.7	2.0/3.6	1.6/3.2	6.0/6.8
Latitude	Average	2.8	4.1	6.1	7.4	8.6	9.2	10.2	9.5	8.2	5.8	3.1	2.4	6.5
	Min/Max	1.9/3.7	2.4/5.5	4.6/7.3	5.6/8.8	6.8/9.7	7.6/10.8	8.8/11.4	7.9/11.2	6.3/9.8	4.0/7.0	2.1/3.9	1.7/3.5	6.0/6.8
Latitude +15	Average	2.9	4.2	6.0	7.1	8.2	8.6	9.6	9.0	8.1	5.8	3.2	2.5	6.3
	Min/Max	1.9/3.9	2.4/5.6	4.5/7.3	5.3/8.5	6.4/9.2	7.1/10.1	8.3/10.8	7.5/10.8	6.1/9.6	4.0/7.1	2.1/4.0	1.8/3.8	5.8/6.6

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	2.9	4.2	6.1	7.6	9.0	9.8	10.7	9.7	8.3	5.9	3.2	2.5	6.7
	Min/Max	1.9/3.9	2.4/5.6	4.6/7.3	5.7/8.9	7.2/10.1	8.1/11.5	9.3/12.1	8.1/11.5	6.3/9.8	4.1/7.1	2.1/4.0	1.8/3.8	6.2/7.1

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	1.4	2.2	3.0	3.5	4.4	5.0	5.8	5.2	4.5	3.4	1.7	1.3	3.5
	Min/Max	0.6/2.5	0.4/3.4	1.9/4.0	2.3/4.6	2.9/5.4	3.6/6.5	4.6/6.9	3.9/6.6	2.9/5.8	1.9/4.3	0.9/2.5	0.6/2.5	3.1/3.8
1-Axis, N-S Horiz Axis	Average	0.9	1.8	3.2	4.5	5.9	6.6	7.8	6.8	5.3	3.1	1.2	0.8	4.0
	Min/Max	0.3/1.6	0.4/2.8	2.1/4.2	2.8/5.7	4.0/7.3	4.7/8.7	6.1/9.3	5.2/8.8	3.3/6.9	1.7/4.1	0.6/1.8	0.4/1.5	3.5/4.4
1-Axis, N-S Tilt=Latitude	Average	1.5	2.6	4.0	4.9	5.8	6.4	7.6	7.1	6.3	4.2	1.9	1.4	4.5
	Min/Max	0.6/2.7	0.5/4.0	2.6/5.3	3.1/6.3	4.0/7.2	4.5/8.4	5.9/9.1	5.4/9.2	4.0/8.1	2.3/5.5	1.0/2.8	0.7/2.6	3.9/4.9
2-Axis	Average	1.7	2.7	4.0	5.0	6.2	6.9	8.1	7.4	6.3	4.3	2.0	1.5	4.7
	Min/Max	0.6/2.9	0.5/4.1	2.6/5.3	3.2/6.4	4.2/7.6	4.9/9.1	6.3/9.7	5.6/9.5	4.0/8.1	2.4/5.6	1.1/2.9	0.7/2.8	4.1/5.1

Average Climatic Conditions

Element	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
Temperature (°C)	-1.3	2.4	6.1	9.7	13.9	18.1	21.1	20.6	15.9	9.9	3.7	-1.2	9.9
Daily Minimum Temp	-5.7	-3.1	-0.7	1.9	5.7	9.6	11.7	11.3	7.0	1.8	-1.7	-5.5	2.7
Daily Maximum Temp	3.1	8.0	12.9	17.3	22.0	26.6	30.4	29.8	24.9	18.0	9.1	3.1	17.1
Record Minimum Temp	-29.4	-31.7	-18.3	-6.7	-3.9	-1.1	1.1	1.7	-4.4	-11.7	-25.0	-27.2	-31.7
Record Maximum Temp	20.0	20.6	26.7	33.3	38.9	39.4	42.2	43.3	37.8	30.6	22.8	19.4	43.3
HDD, Base 18.3°C	608	445	379	260	142	50	11	21	94	260	440	606	3315
CDD, Base 18.3°C	0	0	0	0	4	43	95	90	22	0	0	0	254
Relative Humidity (%)	78	73	61	52	48	47	44	48	56	63	75	80	60
Wind Speed (m/s)	2.6	3.0	3.5	3.8	3.8	3.8	3.6	3.4	3.4	3.0	2.8	2.4	3.3