

Solar Site Assessment

A tool for estimating the impact of collector tilt, orientation and shading

To estimate the performance of a solar energy system we need to know how much solar energy is available for your collector. This worksheet is used to estimate the impact of tilt, orientation and external shading on how much solar energy your solar collectors can collect. The Total Solar Resource Fraction (TSRF) represents the fraction of energy a particular collector would receive when compared to one in the same city, but that has optimal tilt, orientation and no external shading. For example, a collector with a TSRF of 80 percent indicates that 80 percent of the solar energy at your location over a year will be available to the solar collector.

For simplicity we have separated calculating the TSRF into two parts. The first part is to determine the impact of collector tilt and orientation. This Tilt and Orientation Factor (TOF) is estimated using one of the following plots. The second part is to use a sun chart to estimate how much energy is lost on an annual basis from external shading from plants, buildings or other obstructions. The combination of these two effects will provide your collector's TSRF.

TOF graphs (right) show the impact of tilt, and orientation on annual performance of a solar collector. TOF values range from 100% (no loss) at the center of the inner circle to less than 60% (40% or more loss) in the upper left and right corners.

Azimuth angles are based on true polar orientation, adjusted for magnetic declination (16-20 degrees for most of Oregon)

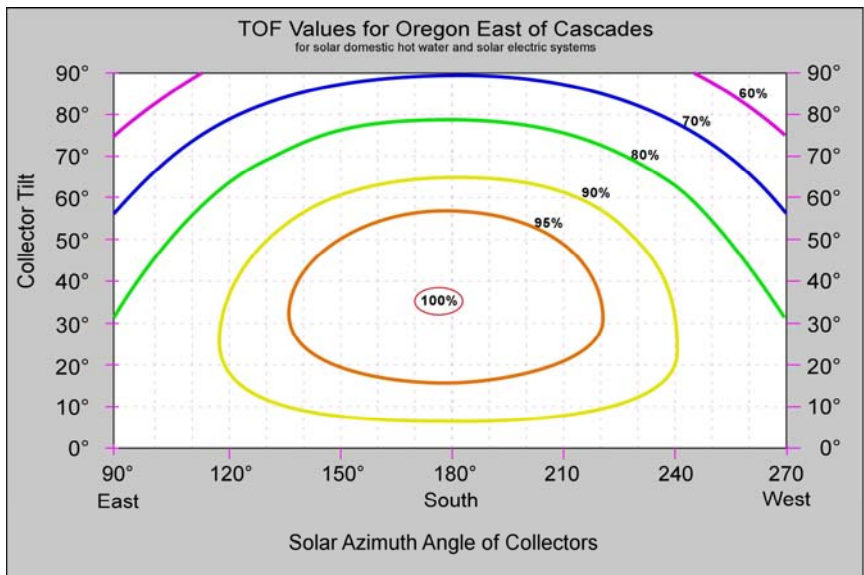
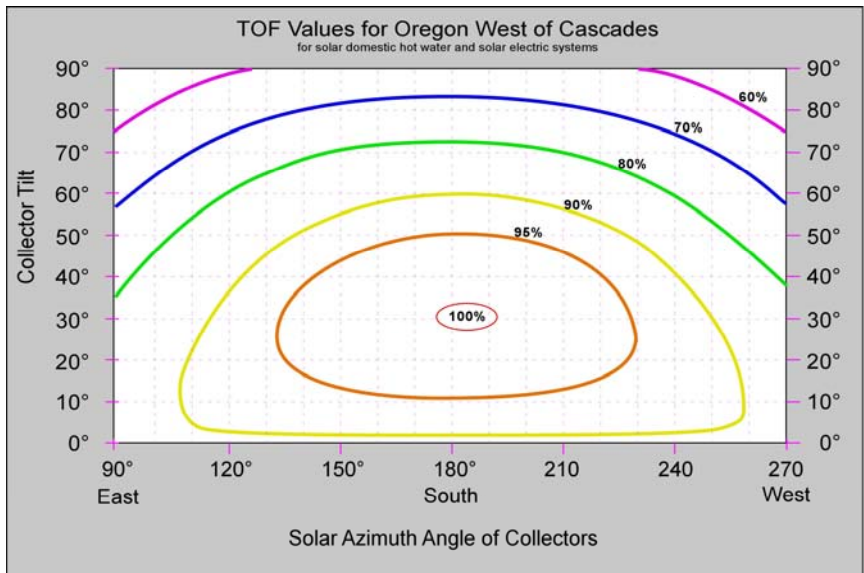
Use the upper graph if your system is installed West of the Cascades.
Use the lower graph if your system is installed East of the Cascades.

Draw a dark X mark the graph for your collector's tilt and azimuth angle. Interpolate between the nearest two lines to estimate the TOF value to the nearest 1%.

Collector Tilt = _____ °
(angle from horizontal)

Solar Azimuth = _____ °
(collector orientation)

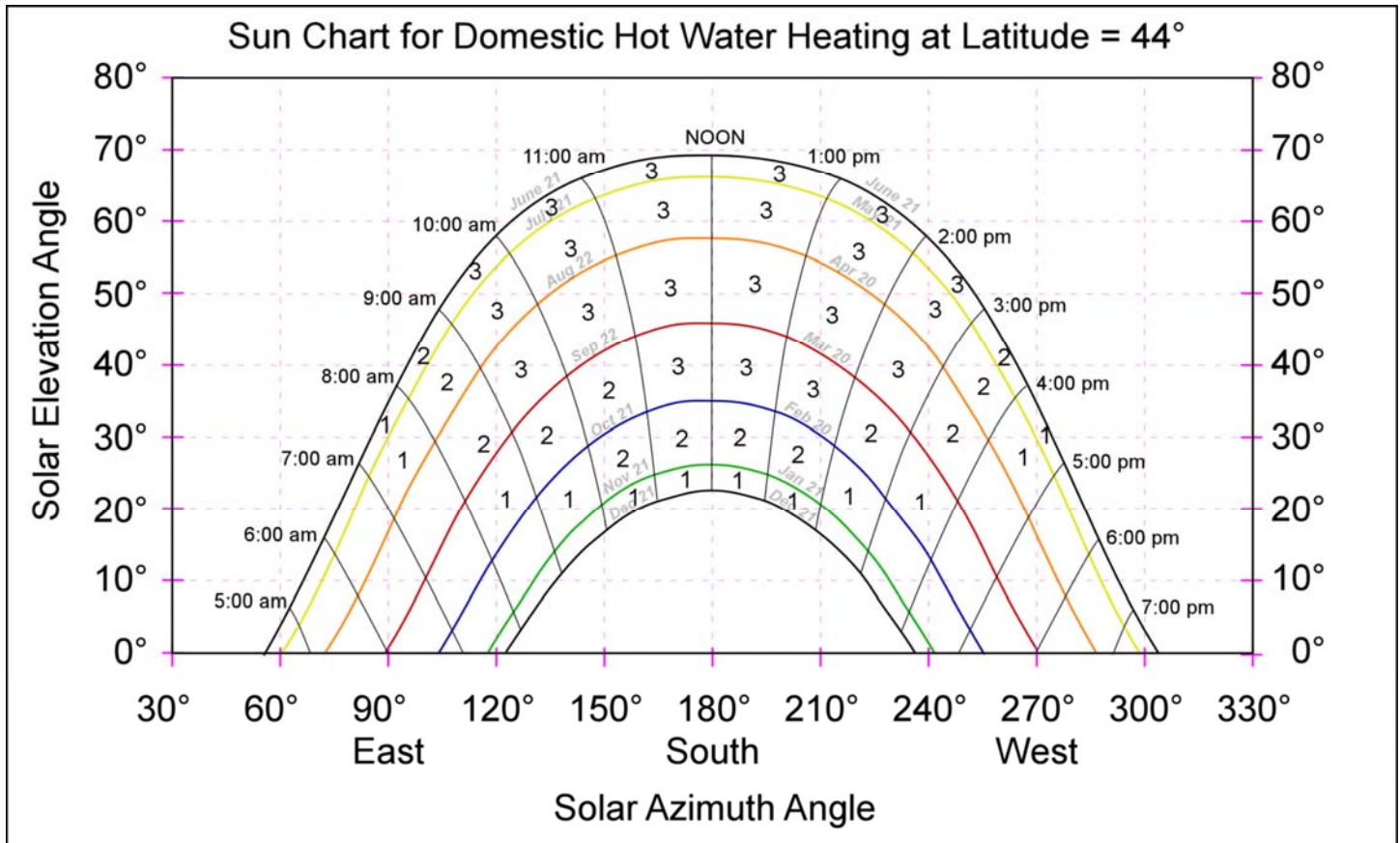
TOF = _____ %
(value from graph)



Sun Chart

For solar water heating and solar electric systems

Step 1 – From the midpoint of the solar array, draw the skyline on the graph below. Use the elevation angles and solar azimuth angles to determine the location of the obstructions. A solar site assessment tool such as the Pathfinder™, or Solmetric Suneye is recommended for increased accuracy. Energy Trust of Oregon sun charts can be used in lieu of the sun chart below. Draw deciduous trees with a dotted outline and fill with light shading. Year-round obstructions like buildings, or evergreen trees should be drawn with solid outlines and filled with heavy shading.



Step 2 – Add up the solar fraction numbers in the sections that have shading. For solar electric systems, partial shading in one section must be counted fully (no fractional amounts). Any deciduous tree shading below the Sept 22/March 20 line can be counted at half value to account for the fact that some light will get through these obstructions when the trees lose their leaves. This sum of all these values inside obstructed areas represents the percent of energy lost to external shading.

$$\text{Percent Not Shaded} = 100\% - \text{Sum of obstructed areas} = \underline{\hspace{2cm}}\%$$

Step 3 – Calculate the Total Solar Resource Fraction using the following equation:

$$\text{Total Solar Resource Fraction} = \text{TOF} \times \text{Percent Not Shaded} = \underline{\hspace{2cm}}\%$$