2. SYSTEM DESIGN & LAYOUT

2.0. Collectors

2.0.0. Solar Fraction

Commercial solar water heating systems are generally different from residential heating systems in the respect that the heating load can be large enough to make maximum solar fraction coverage either economically unfeasible or physically unachievable. As a general rule of thumb, Heliodyne system design aims for the best economic balance with energy production.

For a background, excluding pool systems, because of the non-linearity of collector production (i.e. as temperature goes up, so also do the collector losses), as the system approaches the set temperature the amount of energy collected goes down. Basically, the hotter a collector system is operated, the less output per collector. While adding a second collector on a residential system to achieve the maximum allowable solar fraction is a relatively low investment, on the contrary adding tens of collectors to achieve a higher solar fraction in a commercial system can not only have a significant effect on the first cost of product and installation, but also a very real diminishing return on production.

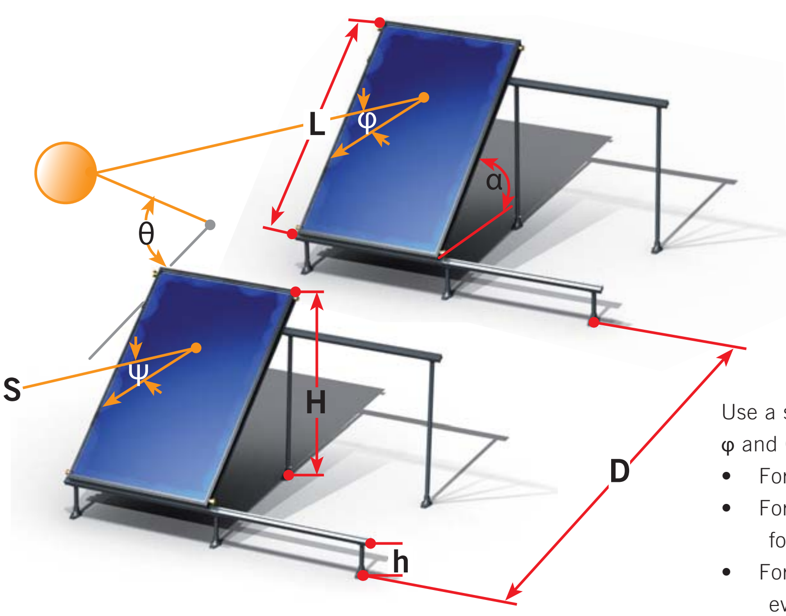
2.0.1. Tilt and Orientation

In the Northern Hemisphere, collectors should be oriented facing due South as much as possible, and conversely in the Southern Hemisphere, collectors should be oriented North. Note that magnetic compass readings can be off by as much as 20°. For systems with constant year round loading, shallower tilts are superior, hovering around a tilt from horizontal equal to latitude and below. Heliodyne recommends at least 10° tilt to ensure debris and water runoff. Variations of azimuth or tilt of up to 15° make less than 5% impact on the solar system production.

2.0.1. Shading

Collectors should be unobstructed at the very least during solar hours of 10AM to 2PM; Heliodyne recommends a shading analysis to be performed at the four corners bordering the installation. In addition, the future condition of the site should be analyzed for potential obstructions over time, such as trees or buildings that could sprout up over the lifetime of the system. Thirty years is a very long time.

While shading due to buildings or vegetation may be unavoidable, shading due to sequential arrays must be avoided entirely. Use the equation below to determine the minimum spacing distance as illustrated.



α, Tilt angle of Collector from Horizontal
L, Length of Collector
φ, Azimuth of Collectors with respect to the sun
θ, Altitude angle of the Sun
H, Vertical height of collector
h, Standoff height of collector
D, Minimum spacing distance
Ψ, Azimuth of Collectors with respect to Due South

$$H = h + [L \cdot \sin(\alpha)]$$

$$D = L \cdot \cos(\alpha) + \left[\frac{L \cdot \sin(\alpha) \cdot \cos(\varphi)}{\tan(\theta)}\right]$$

Use a shade analyzer or solar position tables for the location to determine φ and θ, on the winter solstice, at a time dependent on Ψ.

- For systems facing true south, calculate at 10AM.
- For systems east of south, calculate at 10AM, and subtract one hour for every 15° Ψ is east of south.
- For systems west of south, calculate at 2PM, and add one hour for every 15° Ψ is west of south.