Solar Power Panel Orientation: Landscape vs. Portrait

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Solar Panel Orientation: Landscape vs. Portrait

Maximizing the efficiency of solar installations hinges on the ability to install as many panels as possible in a given area. Often, the question of whether to install the panels in landscape or portrait orientation arises. Common thought suggests that choosing one orientation over the other will lead to the ability to install more panels over a given footprint.

There are two primary issues that result in the debate between which orientation is optimal. The first issue is the number of panels that can be installed in a given length. The example below shows the layout for a given row length and the difference in the number of panels that may installed.

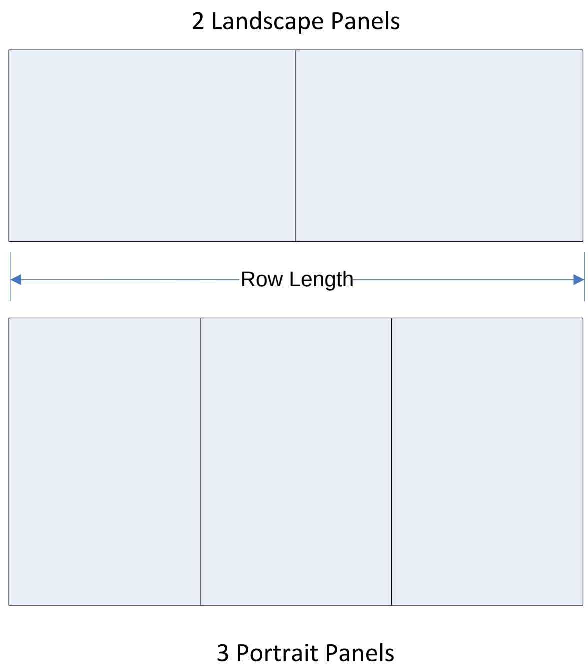

Figure 1 – Number of Panels per Row

As *Figure 1* shows, it is possible to fit more portrait panels within a given row length. This leads to the second issue of how many panels can be installed within a given height. The primary consideration in answering this is the amount of shading provided by a given row. The shading distance is the minimum distance allowed between rows; thus dictating minimum row spacing and ultimately the total number of rows available over a given space. To calculate shading distance, and therefore row spacing, the *Solar Energy Handbook* suggests using the equation $D = Sin(\alpha + \theta) * \frac{H}{Sin\alpha}$ as a method to determine the distance from the front edge of a panel in one row to the front edge of a panel in the next row. The variable (***Θ***) is the tilt of the panels while the variable (***α***) is a function of the latitude of the installation and the optimal sun elevation. The sun elevation (***α***) can be found from a sun chart similar to the one published by the University of Oregon at: http://solardat.uoregon.edu/SunChartProgram.php The variables (***D***) and (***H***) are described in Figure 2.

Solar Panel Orientation: Landscape vs. Portrait

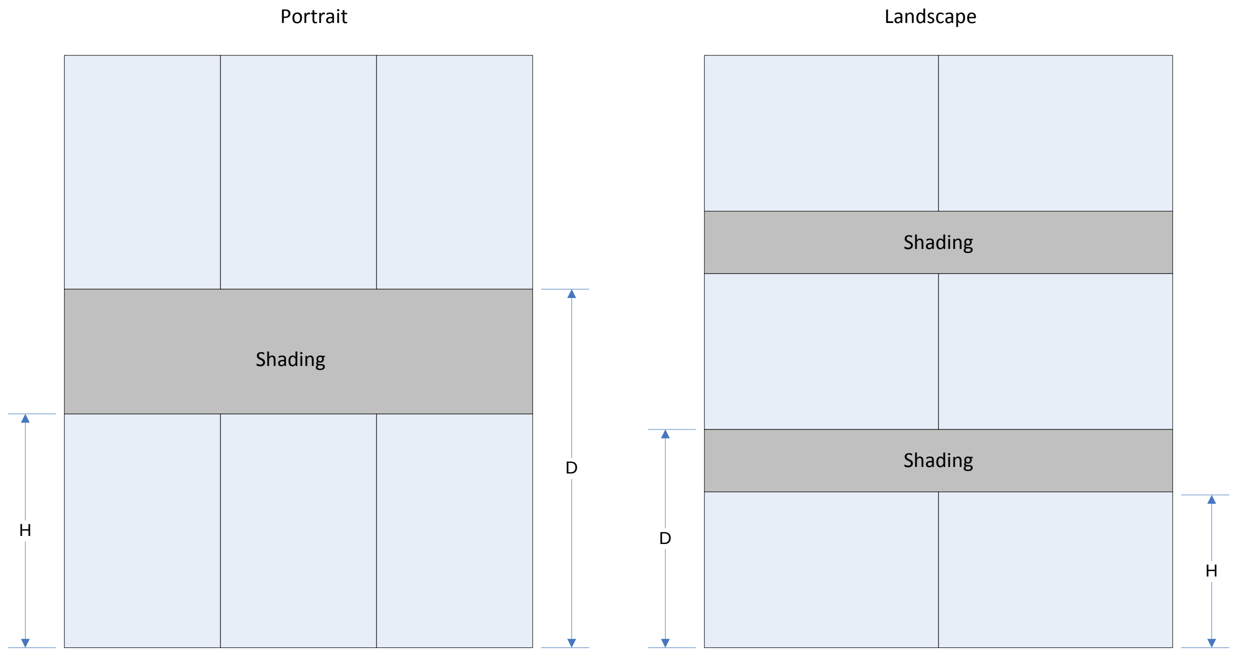

Figure 2 – H is dependent on orientation

As is apparent in the calculation of (***D***), the row spacing is dependent on the height of the panel and the degree of tilt. Therefore, to correctly calculate which orientation will optimize efficiency, both landscape and portrait orientations must be evaluated to determine the relationship that the panel height (***H***) has on the number of panels that can fit into a given area.

To do this, it is appropriate to determine the maximum number of panels (***n***) that can fit into a given area (***A)*** in both landscape and portrait orientation. The first step in the calculation is to determine the required row spacing. The height of the panel (***H***) is defined by the width (***W***) in landscape orientation and the Length (***L***) in portrait orientation. In *Figure 3*, (***H***) has been replaced with the appropriate dimension.

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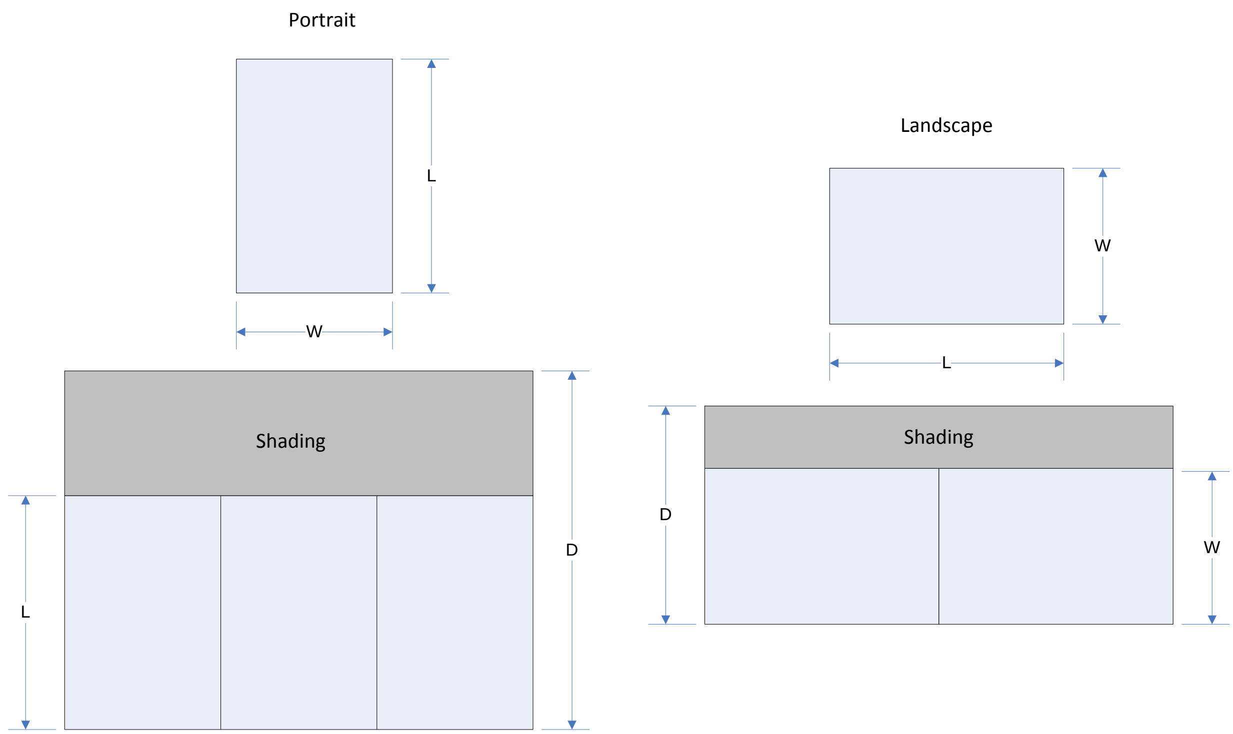

Figure 3 – Replacing H

By replacing (***H***) in the spacing equation with the respective dimension for both portrait (***L***) and landscape (***W***) we establish a spacing equation for both orientations as displayed in *Figure 4*.

Portrait

$$D = \sin(\alpha + \theta) * \frac{L}{\sin \alpha}$$

Landscape

$$D = \sin(\alpha + \theta) * \frac{W}{\sin \alpha}$$

Figure 4 – Spacing equations

Now, for a given area (***A***), we can determine the number of panels (***n***) that will occupy the area (***A***) for both landscape and portrait as shown in *Figure 5*.

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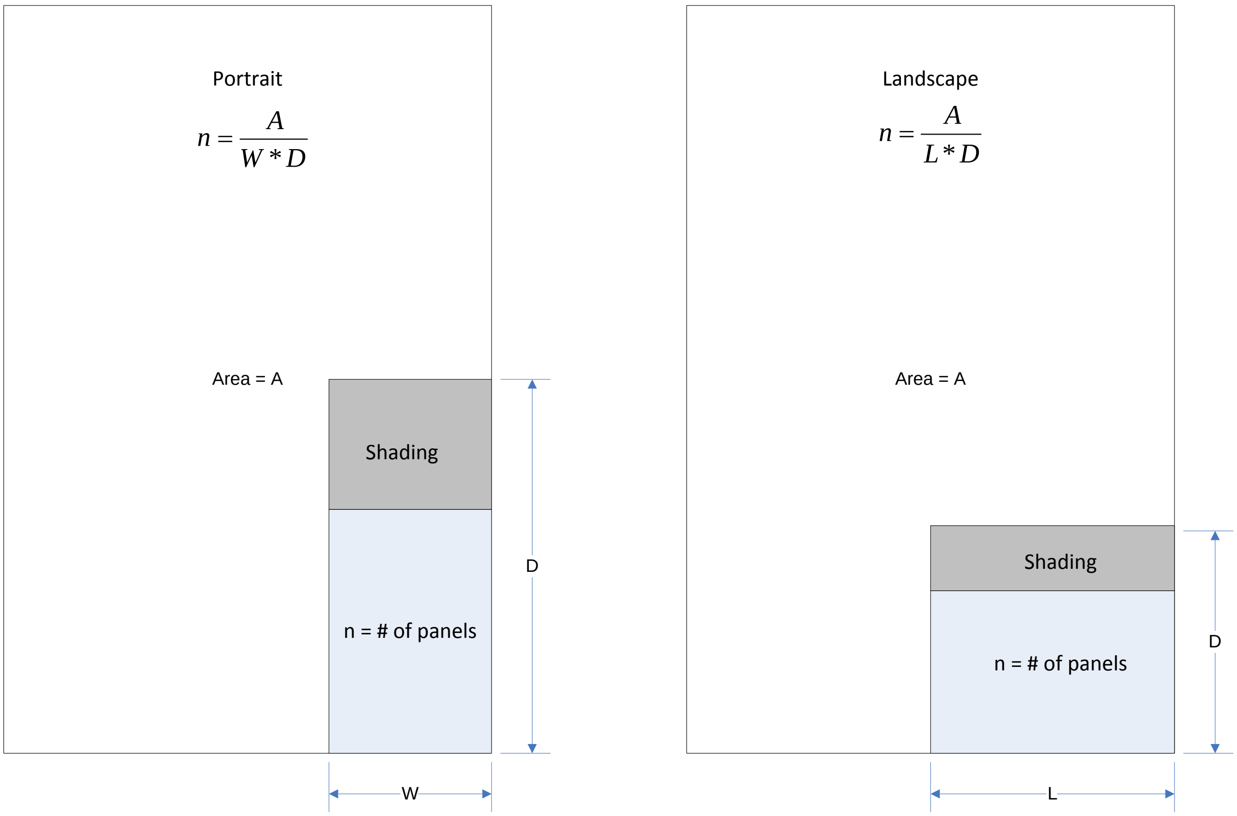

Figure 5 – Number of Panels in an Given Area

Finally, by replacing (***D***) with the spacing equation and multiplying through we get the result in *Figure 6*.

Portrait

$$n = \frac{A}{W * D}$$

$$= \frac{A}{W * \sin(\alpha + \theta) * \frac{L}{\sin \alpha}}$$

$$= \frac{A * \sin \alpha}{\sin(\alpha + \theta) * L * W}$$

Landscape

$$n = \frac{A}{L * D}$$

$$= \frac{A}{L * \sin(\alpha + \theta) * \frac{W}{\sin \alpha}}$$

$$= \frac{A * \sin \alpha}{\sin(\alpha + \theta) * L * W}$$

Figure 6 – Landscape and Portrait Equations

Solar Panel Orientation: Landscape vs. Portrait

As *Figure 6* shows, the number of panels that fit into a given area (***A***) are equal.

Portrait

$$\frac{A * \sin\alpha}{\sin(\alpha+\theta) * L * W}$$

Landscape

$$\frac{A * \sin\alpha}{\sin(\alpha+\theta) * L * W}$$

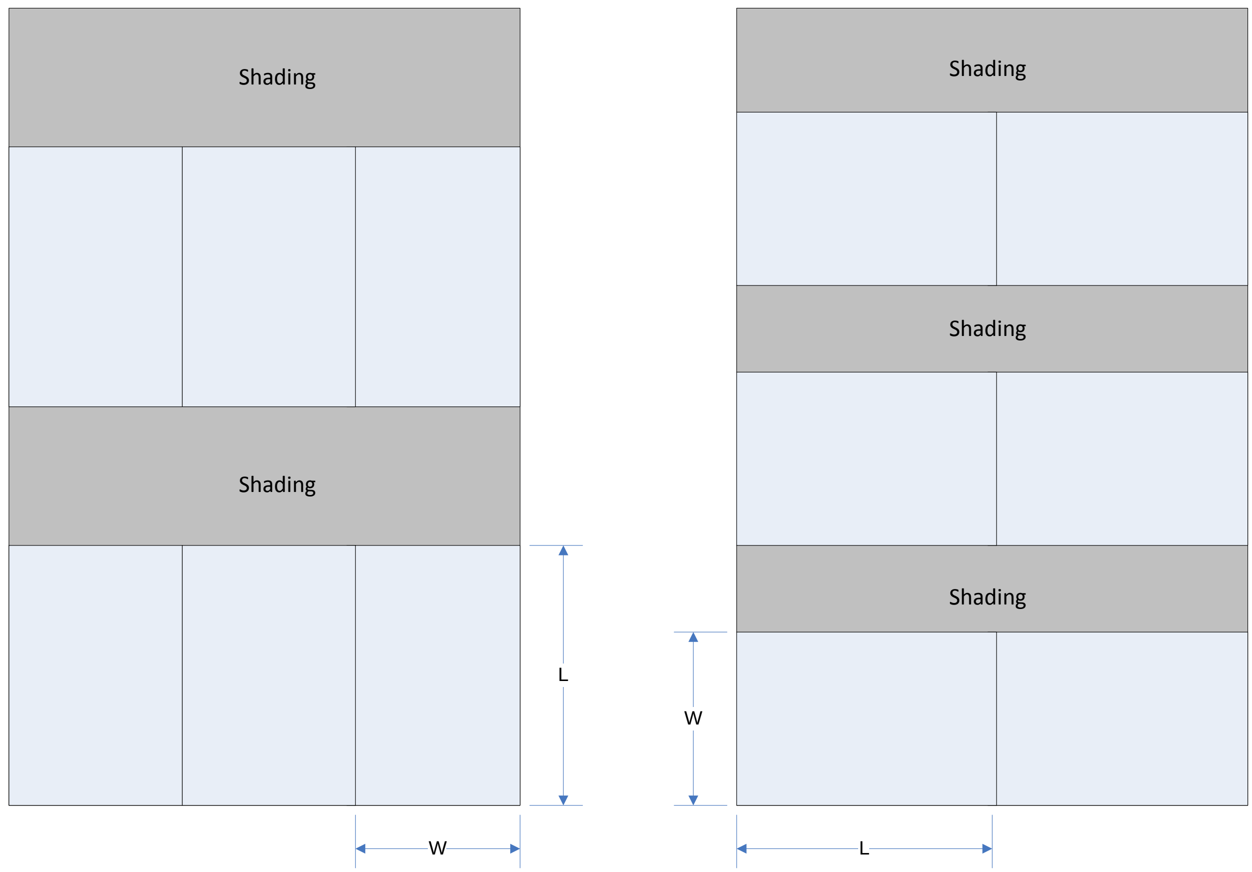

Figure 7 – Landscape and Portrait are Equal

In summary, panels can be oriented in the landscape or portrait orientation with no affect on the quantity of panels that can be installed. Therefore, there is no affect on array efficiency over a given rooftop space or given ground space . Due to this fact, efficiency optimization decisions should be based on optimizing panel efficiency and racking systems rather than on the number of panels dictated by a particular orientation.

For further information regarding solar panel orientation please visit www.cooperblinesolar.com.