

# Theoretical Comparative Energy Efficiency Analysis of Dual Axis Solar Tracking Systems

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## Abstract

This paper developed a theoretical model substantially based on the principle that only the normal component of solar radiation is actually converted into electrical energy. This theoretical model helped to predict minimum and maximum daily energy gain (compared to static PV system tilted with certain angle) when using dual axis PV solar tracking systems, at any given location on earth without prior experimental data. Based on equations derived from model, minimum and maximum energy gain is computed and summarized in tables of minimum and maximum. Furthermore, the model equations could be used to set up future experimental studies related to the matter.

## Keywords

Solar Tracking Systems, Dual Axis, PV, Energy Efficiency, Optimum Tilt Angle

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## 1. Introduction

The tracking mechanism is an electromechanical system that ensures solar radiation is always perpendicular to the surface of photovoltaic cells which maximize energy harnessing [1]. There are mainly two types of solar trackers based on the basis of their movement degrees of freedom [1]. These are single axis solar tracker and dual axis solar tracker [1]. Active, passive and chronological trackers are three of them [1]. The literature is rich in solar trackers design models developed and experimented [1]-[11].

[1] designed and built a hybrid solar tracking system whose energy efficiency was compared to continuous solar tracking systems (dual axis solar tracker) in terms of power consumption (due to actuators/motors); afterwards energy gain comparisons are performed between the four basic solar trackers: hybrid, continuous (dual), single axis solar trackers and static tilted PV systems. The experi-

ments performed by [1] in Dhaka Bangladesh ( $23^{\circ}42'0''\text{N } 90^{\circ}22'30''\text{E}$ ) concluded that the average power gain of continuous tracking system over the static panel is 28.10% while [10] concluded that, after experimentation performed in South Africa, the additional energy gain achieved by dual axis solar tracking systems was about 37% compared to static PV systems.

The study performed by [5] in Eskisehir region ( $39.78^{\circ}\text{N } 30.52^{\circ}\text{E}$ ) concluded 33% energy gain of the experimental solar tracking system over the fixed PV panels. [3] focused on developing better LDR (Light Dependent Resistors) sensors which could increase the PV performance of sunlight tracking and concluded that energy efficiency could be increased up to 60% compared to static PV.

[4] presented the performance of dual axis solar tracker and static solar system with respect to clearness index in Malaysia and mentioned that the efficiency of DAST (Dual Axis Solar Tracker) over SSS (Static Solar System) varies from 24.91% at an overcast day to 82.12% at a clear day; while [11] calculated the efficiency of dual axis solar tracking systems over that of the static panel to be 81.68%.

It appears that the aforementioned investigations concluded different numerical values regarding the energy gain achieved by dual axis solar tracking system over static PV system. The apparent discrepancies should be explained and understood through a theoretical framework: that is one of the motivations of this article. But the primarily motivation comes through the lack of methods or models that enable solar tracking systems efficiency experimentation results generalization, observed in the previous investigations related to the matter.

Therefore the major goal of this paper is to carry out results generalization of dual axis solar tracking systems energy efficiency over tilted static PV array depending on parameters that should be rigorously defined.

## 2. Theoretical Assumptions

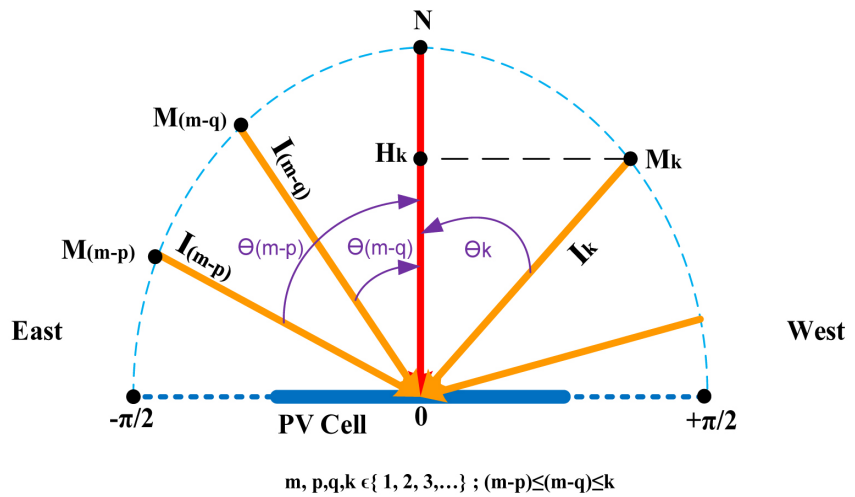
Solar radiation is made up of three components: direct, diffuse and reflective. The uncertainty in predicted tilted irradiance is generally caused by the direct/diffuse separation [6]. In order to remove that uncertainty, we assume a clear sky conditions in which the major part of total irradiance is direct irradiance as concluded by many studies. Since the total irradiance is reduced to direct one, the total solar irradiance is represented by the single vector  $\mathbf{I}_k$  (Figure 1). Intuitively we assume that the normal component of  $\mathbf{I}_k$  is the only one which is actually converted into electrical power through PV cells array. Hence, the model assumptions are summarized as follows:

**A1:** Total solar irradiance is represented by vector  $\mathbf{I}_k$ . Magnitude of vector  $\mathbf{I}_k$  is assumed to be the same in all directions.

**A2:** Normal component of  $\mathbf{I}_k$  is the only one which is actually converted into electrical energy.

## 3. Solar Noon, Best Slope Angle of a Tilted PV Cells Array

The hour angle  $\omega$  is zero at local noon (when the sun reaches its highest point



**Figure 1**<sup>1</sup>. Solar radiation normal components.

in the sky) [9]. On any day of the year, the most direct solar radiation at a given location occurs at solar noon [9]. Then, solar elevation angle  $\alpha$  is defined as:

1) In the Northern hemisphere:

$$\alpha = 90^\circ - (\varphi - \delta) \tag{1}$$

2) In the southern hemisphere:

$$\alpha = 90^\circ + (\varphi - \delta) \tag{2}$$

where:

$\varphi$  is the latitude of location (See Appendix 1).

$\delta$  is the solar declination angle (See Appendix 1).

Let's consider PV cells array. When PV cells lie down in horizontal position, solar radiation reaches the PV cells under angle  $\alpha$  (which is not necessary equal to  $90^\circ$ ). It points out the need to make PV cells tilt with a certain angle  $\beta$  called inclination angle (or tilt angle) so that the solar radiation is perpendicular to PV cells. Therefore, the best slope angle on a particular day of the year can be defined as the angle  $\beta$  such that:

$$\alpha + \beta = 90^\circ \tag{3}$$

Most of previous studies show that optimal fixed tilt angle of PV panels is south facing in the Northern Hemisphere and north facing in the Southern Hemisphere [12].

In this paper fixed (static) tilted PV cells are always assumed to be either north facing or south facing according the location in Northern Hemisphere or Southern Hemisphere

#### 4. PV Dual Axis Solar Tracking System versus Particular Case of Best-Slope-Angle Tilted Static PV Cells Array

1) Let's consider a static tilted (with the best slope angle) PV cell in a particu-

<sup>1</sup>PV cell in **Figure 1** should be understood as a tilted PV plane.

lar location of the earth and in a particular clear sky day of the year. In addition let's denote  $T$  the length of the day (*i.e.*, the time interval between the sunrise and the sunset). We could reasonably define a set of discrete points

$\{M_1, M_2, \dots, M_{m-p}, \dots, M_{m-q}, \dots, M_k, \dots, M_m\}$  by which the sun apparent position goes through, as it moves from East to West.

The solar irradiance at time  $t_k$  ( $0 \leq t_k \leq T$ ) of the day is defined as:

$$I_k = M_k O \quad (4)$$

2) If integer  $m \rightarrow +\infty$ , the discrete function  $\theta_k$  can be expressed as continuous time function  $\theta(t)$ :

$$\theta(t) = \Omega t - \frac{\pi}{2} \quad (5)$$

where:

- $\Omega = \frac{\pi}{T}$  defines the angular speed of sun apparent rotation;
- $0 \leq t \leq T$ .

And the discrete normal component  $I_{kn}$  becomes a continuous component  $I_n(t)$ :

$$I_n(t) = [\cos(\theta(t))] \cdot NO \quad (6)$$

The total solar energy (radiation)  $R$  captured and actually converted into electrical energy by PV cells is evaluated:

$$R = \int_0^T |I_n(t)| dt = \frac{2}{\pi} (I_{\max} * T) \quad (7)$$

3) Dual axis solar tracking system ensures that solar radiation is normal at any time of the day. Therefore, the total solar energy (radiation)  $R_{\max}$  captured by such a system is computed as:

$$R_{\max} = I_{\max} * T \quad (8)$$

(7) and (8) yield:

$$R_{\max} = \frac{\pi}{2} R \cong R + (0.57 * R) \quad (9)$$

As the output electrical energy is in general considered to be proportional to the solar energy radiation, from (9) it can be stated that PV dual axis solar tracking system energy efficiency is about 60% higher than that of a best-slope-angle static tilted PV system.

## 5. PV Dual Axis Solar Tracking System versus Static Tilted PV Cells Array

Let's consider a static tilted PV cell located in Northern Hemisphere (**Figure 2**).

Furthermore, we consider an orthonormal rectangular coordinates system associated with the static tilted PV plane as shown in **Figure 4**.

The normal irradiance to PV plane is represented by  $ON$  and defined as:

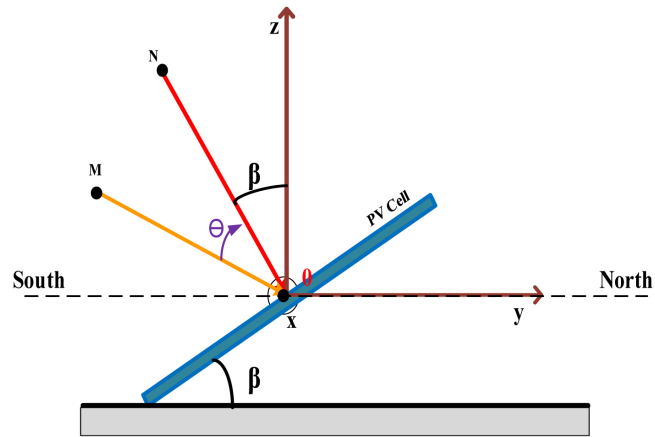


Figure 2. Axes of coordinates system tied to static tilted PV plane.

$$ON \begin{pmatrix} 0 \\ -I_{\max} \sin(\beta) \\ I_{\max} \cos(\beta) \end{pmatrix} \tag{10}$$

where:

$\beta$  is the slope angle of PV cell plane.

$I_{\max}$  denotes the magnitude of  $ON$ .

Solar apparent position, at any time, of the day is located by:

$$OM \begin{pmatrix} I_{\max} \cos(\alpha) \sin(\gamma) \\ I_{\max} \cos(\alpha) \cos(\gamma) \\ I_{\max} \sin(\alpha) \end{pmatrix} \tag{11}$$

where:

$\alpha$  denotes solar elevation (See Appendix 1);

$\gamma$  denotes solar azimuth angle (See Appendix 1).

Equation (11) is valid only if the horizontal axe of PV plane is rigorously aligned (parallel) with North-South direction.

Let's introduce angle  $\lambda$  to take into account the fact that the horizontal axe of PV plane could be lightly either South-East and North-West oriented or South-West and North-East oriented (Figure 3).

(11) becomes then:

$$OM \begin{pmatrix} I_{\max} \cos(\alpha) \sin(\gamma + \lambda) \\ I_{\max} \cos(\alpha) \cos(\gamma + \lambda) \\ I_{\max} \sin(\alpha) \end{pmatrix} \tag{12}$$

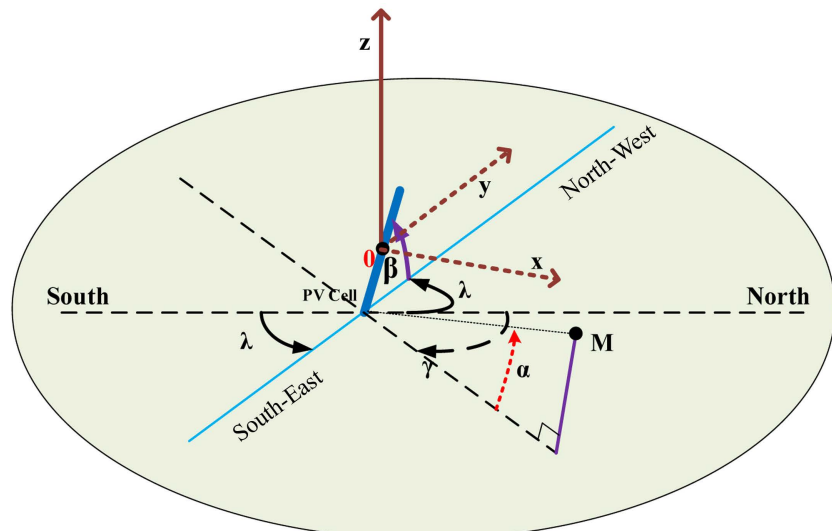
Computing the scalar product of  $OM$  and  $ON$  it comes:

$$\cos \theta = C_1 + C_2 \cos \omega + C_3 \sin \omega \tag{13}$$

where:

$$C_1 = \sin \delta (\cos \beta \sin \varphi - \sin \beta \cos \varphi \cos \lambda) \tag{14}$$

$$C_2 = \cos \delta (\cos \beta \cos \varphi + \sin \beta \sin \varphi \cos \lambda) \tag{15}$$



$\lambda=90^\circ$  when PV cells array is East oriented and  $\lambda=-90^\circ$  for West oriented PV cells array

**Figure 3.** Deviation angle ( $\lambda$ ) of static tilted PV plane from north-south direction.

$$C_3 = \sin \beta \cos \delta \sin \lambda \tag{16}$$

Let's denote  $R$  the total solar energy captured by tilted PV plane with slope angle  $\beta$  and azimuthal direction  $(\pi - \lambda)$ . Likewise (7):

$$R = \int_{T_{rise}}^{T_{set}} |I_n(t)| dt = I_{max} \int_{T_{rise}}^{T_{set}} |\cos \theta| dt \tag{17}$$

where:

$T_{rise}$  denotes time of sunrise (see Appendix 1);

$T_{set}$  denotes time of sunset (see Appendix 1).

From (13) and (17), derives:

$$R_{max} = R \frac{\pi T_0}{\left[ C_1 \pi T_0 + 12 C_2 \sin \left( \frac{\pi T_0}{12} \right) \right]} \tag{18}^2$$

Let' set:

$$K = \frac{\pi T_0}{\left[ C_1 \pi T_0 + 12 C_2 \sin \left( \frac{\pi T_0}{12} \right) \right]} \tag{19}$$

(18) yields:

$$R_{max} = R + (K - 1)R \tag{20}$$

The amount of energy increase by a dual axis solar tracking system compared to static tilted PV system, in Northern Hemisphere, can be measured by:

$$\eta(\varphi, \beta, n) = K(\varphi, \beta, n) - 1 \tag{21}$$

In Southern Hemisphere variables  $\varphi$  and  $\beta$  should be replaced by their opposites, *i.e.*  $-\varphi$  and  $-\beta$ .

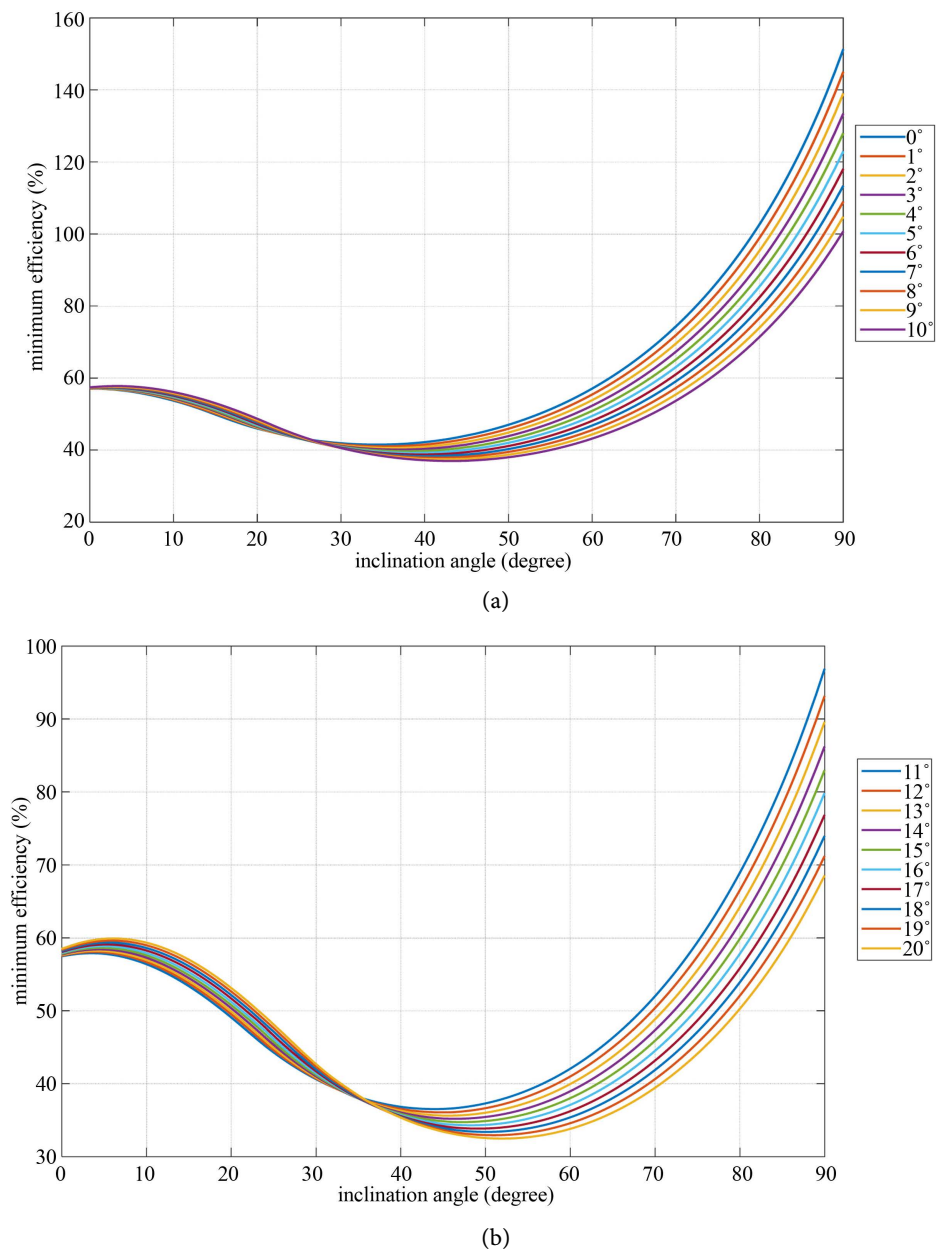
<sup>2</sup>(18) is valid only if  $\lambda$  is set to zero.

## 6. Efficiency Computations Results and Discussion

The efficiency factor  $\eta$  is computed using Matlab for a range of latitudes  $\varphi$  (that are not in particular cases of latitudes for which there is no sunrise or sunset), slope angles  $\beta$  of PV plane and for each day of the year.

Two tables are computed: the first (Tables A1-A6) gives minimum daily efficiencies (in percent) and the second (Tables A7-A12) gives maximum daily efficiencies, when latitude and inclination angles are set to be constant.

The plots of minimum efficiencies (Figure 4), as an illustration show, depending on inclination angle, that minimum efficiencies could be either increased or decreased.



**Figure 4.** Minimum efficiencies plot (a) for latitudes 0° to 10°; (b) for latitudes 11° to 20°.

The first major result which derives from minimum efficiencies table (**Tables A1-A6**) is that for any location on the earth there is particular slope angle which achieves the minimum of minimum efficiencies on a specific day.

*Example 1: For latitude  $40^\circ$ , the minimum of minimum efficiencies is reached at slope angle  $\beta = 69^\circ$  on day number  $n = 355$ .*

The second major result which derives from minimum efficiencies table is a straightforward method for yearly optimum slope angle determination of static PV cells array: the optimum slope angle is the (minimum in case of more than one) slope angle for which minimum efficiency is closest to  $(\frac{\pi}{2} - 1)$ , i.e. to 57%.

*Example 2: For latitude  $0^\circ$  the slope angle which has the minimum efficiency closest to 57% is  $0^\circ$ , so  $0^\circ$  is the yearly optimum angle, and for latitude  $12^\circ$ , the optimum slope angle would be  $9^\circ$ .*

The experimental efficiencies held in previous works could not be accurately compared to data of **Tables A1-A6** and **Tables A7-A12** due to the fact that efficiency parameters (latitude, inclination angle of static PV cells array and day number), very often, are not explicitly and completely mentioned.

## 7. Conclusions

In this paper, energy gain factor (efficiency) of dual axis PV solar tracking systems compared to static (fixed) tilted PV arrays has been explicitly defined as a function of latitude, inclination angle, azimuthal deviation and day number, in a theoretical framework from theoretical model. Afterwards equation (21) computations using Matlab yielded **Tables A1-A6** and **Tables A7-A12** which, respectively, give minimum daily and maximum daily efficiencies for a wide range of latitudes and inclination angles.

The work carried out also gives an important theoretical framework necessary for precise experimental investigations so that **Tables A1-A6** and **Tables A7-A12** data could be compared to experimental data. It also suggested a straightforward method for optimum slope angle determination of static PV cells array. That method should be fully investigated and assessed in future works related to the matter. Another important research direction could be to analyze how meteorological conditions (cloudy or clear sky conditions) could alter the results of this paper.

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## Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

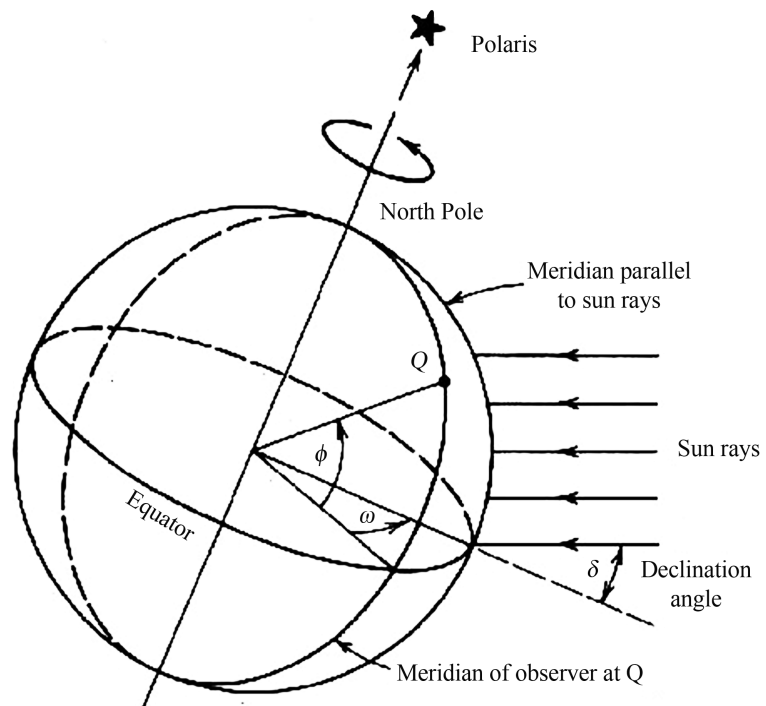


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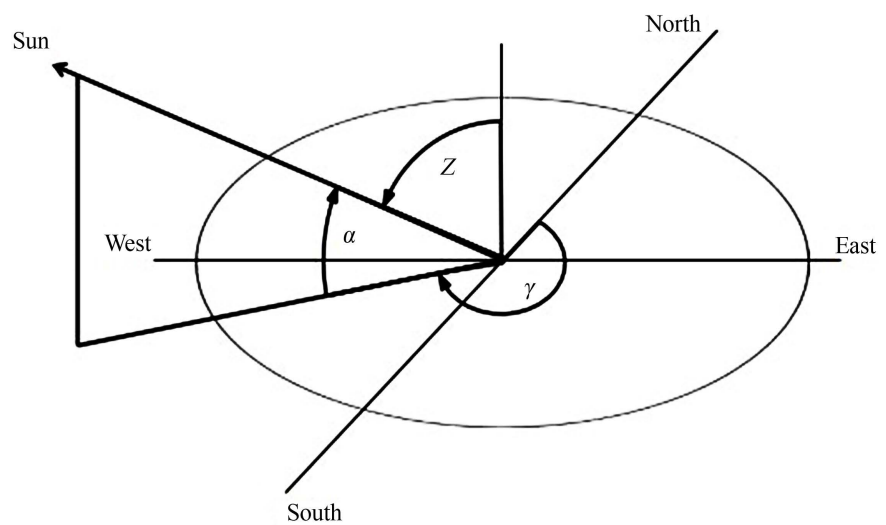
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## Appendix

The earth follows a complex motion that consists of the daily motion and the annual motion. The daily motion causes the sun to appear in the east to west direction over the earth whereas the annual motion causes the sun to tilt at a particular angle while moving along east to west direction [1]. Declination angle  $\delta$  (Figure A1 [7]) accounts for annual motion; azimuth angle  $\gamma$  (Figure A2 [8]) and elevation (or altitude) angle  $\alpha$  (Figure A2 [8]) characterize the daily motion.



**Figure A1.** Declination angle ( $\delta$ ), Latitude ( $\phi$ ) and Hour angle ( $\omega$ ).



**Figure A2.** Solar Azimuth angle ( $\gamma$ ), Elevation angle ( $\alpha$ ) and Zenith angle ( $Z$ ).

1) Sun declination angle  $\delta$  is defined to be that angle made between a ray of the sun, when extended to the center of the earth and the equatorial plane [9].

$$\delta = 23.45 \sin \left[ 360 \left( \frac{284 + n}{365} \right) \right]$$

where:

$\delta$  : Declination angle in degrees;

$n$ : day number ( $n = 1$  at the first of January).

2) Solar elevation (altitude) angle  $\alpha$  (**Figure A2**) is the angle between the projection of the sun's rays on the horizontal plane and the direction on the sun's rays [7].

From [9]:

$$\alpha = \sin^{-1} (\sin \delta \sin \varphi + \cos \delta \cos \varphi \cos \omega)$$

where:

$\delta$  : Declination angle;

$\varphi$  : Observer's latitude;

$\omega$  : hour angle.

3) Hour angle ( $\omega$ ) is the angular displacement from east to west of the local meridian due to rotation of the earth on its axis at  $15^\circ$  per hour [7]:

$$\omega = 15(t - 12)$$

4) Latitude  $\varphi$  (**Figure A1**) of a location on the earth is the angle between the line joining that location to the center of the earth and the equatorial plane [9].

5) Zenith angle  $Z$  (**Figure A2**) is the complement of altitude angle [7]:

$$Z = 90^\circ - \alpha$$

6) Azimuth angle  $\gamma$  is the local angle between the direction of due north and that of the perpendicular projection of the sun down onto the horizon line measured clockwise [9].

The following relation relates the sun azimuth angle and its elevation angle:

$$\cos \alpha \cos \gamma = \sin \delta \cos \varphi - \cos \delta \sin \varphi \cos \omega$$

It can also be shown that:

$$\cos \alpha \sin \gamma = \cos \delta \sin \omega$$

7) Latitude  $\varphi$  (denoted by  $\phi$  on **Figure A1**) of a location on the earth is the angle between the line joining that location to the center of the earth and the equatorial plane [9].

8) Sunrise and sunset time equations are defined as follows:

$$T_{rise} = 12 - T_0$$

$$T_{set} = 12 + T_0$$

With

$$T_0 = \frac{12}{\pi} \cos^{-1} (-\tan \varphi \tan \delta)$$

**Table A1.** Minimum daily efficiencies (in percent) for latitudes [0°, 65°]; slope angles [0°, 15°].

|    | 0     | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    | 12    | 13    | 14    | 15    |
|----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 0  | 57.08 | 57.04 | 56.94 | 56.77 | 56.52 | 56.21 | 55.84 | 55.40 | 54.89 | 54.33 | 53.72 | 53.04 | 52.32 | 51.55 | 50.74 | 49.89 |
| 1  | 57.08 | 57.07 | 56.99 | 56.83 | 56.61 | 56.32 | 55.97 | 55.55 | 55.07 | 54.52 | 53.92 | 53.27 | 52.56 | 51.81 | 51.01 | 50.17 |
| 2  | 57.09 | 57.10 | 57.04 | 56.91 | 56.71 | 56.44 | 56.11 | 55.71 | 55.25 | 54.72 | 54.14 | 53.50 | 52.81 | 52.07 | 51.28 | 50.46 |
| 3  | 57.11 | 57.14 | 57.10 | 56.99 | 56.81 | 56.57 | 56.25 | 55.87 | 55.43 | 54.92 | 54.36 | 53.74 | 53.06 | 52.34 | 51.57 | 50.75 |
| 4  | 57.13 | 57.18 | 57.17 | 57.08 | 56.92 | 56.70 | 56.41 | 56.05 | 55.62 | 55.14 | 54.59 | 53.98 | 53.33 | 52.61 | 51.86 | 51.05 |
| 5  | 57.16 | 57.23 | 57.24 | 57.18 | 57.04 | 56.84 | 56.56 | 56.23 | 55.82 | 55.35 | 54.82 | 54.24 | 53.59 | 52.90 | 52.15 | 51.36 |
| 6  | 57.19 | 57.29 | 57.32 | 57.28 | 57.16 | 56.98 | 56.73 | 56.41 | 56.03 | 55.58 | 55.06 | 54.49 | 53.87 | 53.19 | 52.45 | 51.67 |
| 7  | 57.23 | 57.35 | 57.40 | 57.38 | 57.29 | 57.13 | 56.90 | 56.60 | 56.24 | 55.81 | 55.31 | 54.76 | 54.15 | 53.48 | 52.76 | 52.00 |
| 8  | 57.28 | 57.42 | 57.50 | 57.50 | 57.43 | 57.29 | 57.08 | 56.80 | 56.46 | 56.05 | 55.57 | 55.03 | 54.44 | 53.78 | 53.08 | 52.33 |
| 9  | 57.33 | 57.50 | 57.60 | 57.62 | 57.57 | 57.46 | 57.27 | 57.01 | 56.68 | 56.29 | 55.83 | 55.31 | 54.73 | 54.10 | 53.41 | 52.66 |
| 10 | 57.39 | 57.58 | 57.70 | 57.75 | 57.73 | 57.63 | 57.46 | 57.23 | 56.92 | 56.54 | 56.10 | 55.60 | 55.04 | 54.42 | 53.74 | 53.01 |
| 11 | 57.46 | 57.68 | 57.82 | 57.89 | 57.89 | 57.81 | 57.67 | 57.45 | 57.16 | 56.81 | 56.38 | 55.90 | 55.35 | 54.74 | 54.08 | 53.36 |
| 12 | 57.54 | 57.78 | 57.94 | 58.03 | 58.05 | 58.00 | 57.88 | 57.68 | 57.41 | 57.08 | 56.67 | 56.20 | 55.67 | 55.08 | 54.43 | 53.73 |
| 13 | 57.62 | 57.88 | 58.07 | 58.19 | 58.23 | 58.20 | 58.09 | 57.92 | 57.67 | 57.36 | 56.97 | 56.52 | 56.00 | 55.43 | 54.79 | 54.10 |
| 14 | 57.72 | 58.00 | 58.21 | 58.35 | 58.41 | 58.40 | 58.32 | 58.17 | 57.94 | 57.64 | 57.28 | 56.84 | 56.34 | 55.78 | 55.16 | 54.48 |
| 15 | 57.82 | 58.12 | 58.36 | 58.52 | 58.61 | 58.62 | 58.56 | 58.43 | 58.22 | 57.94 | 57.59 | 57.18 | 56.69 | 56.15 | 55.54 | 54.87 |
| 16 | 57.93 | 58.26 | 58.51 | 58.70 | 58.81 | 58.85 | 58.81 | 58.70 | 58.51 | 58.25 | 57.92 | 57.52 | 57.06 | 56.52 | 55.93 | 55.27 |
| 17 | 58.05 | 58.40 | 58.68 | 58.89 | 59.02 | 59.08 | 59.07 | 58.97 | 58.81 | 58.57 | 58.26 | 57.88 | 57.43 | 56.91 | 56.33 | 55.69 |
| 18 | 58.18 | 58.56 | 58.86 | 59.09 | 59.25 | 59.33 | 59.33 | 59.26 | 59.12 | 58.90 | 58.61 | 58.24 | 57.81 | 57.31 | 56.74 | 56.11 |
| 19 | 58.32 | 58.72 | 59.05 | 59.30 | 59.48 | 59.59 | 59.61 | 59.57 | 59.44 | 59.24 | 58.97 | 58.62 | 58.21 | 57.72 | 57.17 | 56.55 |
| 20 | 58.48 | 58.90 | 59.25 | 59.53 | 59.73 | 59.86 | 59.91 | 59.88 | 59.78 | 59.60 | 59.34 | 59.02 | 58.61 | 58.14 | 57.60 | 57.00 |
| 21 | 58.64 | 59.09 | 59.46 | 59.76 | 59.99 | 60.14 | 60.21 | 60.21 | 60.13 | 59.97 | 59.73 | 59.42 | 59.04 | 58.58 | 58.06 | 57.46 |
| 22 | 58.82 | 59.29 | 59.69 | 60.01 | 60.26 | 60.44 | 60.53 | 60.55 | 60.49 | 60.35 | 60.13 | 59.84 | 59.47 | 59.03 | 58.52 | 57.94 |
| 23 | 59.02 | 59.51 | 59.93 | 60.28 | 60.55 | 60.75 | 60.87 | 60.91 | 60.87 | 60.75 | 60.55 | 60.28 | 59.92 | 59.50 | 59.00 | 58.44 |
| 24 | 59.22 | 59.74 | 60.19 | 60.56 | 60.86 | 61.08 | 61.22 | 61.28 | 61.26 | 61.16 | 60.98 | 60.73 | 60.39 | 59.98 | 59.50 | 58.95 |
| 25 | 59.45 | 59.99 | 60.46 | 60.86 | 61.18 | 61.42 | 61.58 | 61.67 | 61.67 | 61.59 | 61.43 | 61.20 | 60.88 | 60.48 | 60.01 | 59.47 |
| 26 | 59.69 | 60.26 | 60.75 | 61.17 | 61.52 | 61.78 | 61.97 | 62.08 | 62.10 | 62.04 | 61.90 | 61.68 | 61.38 | 61.00 | 60.55 | 60.02 |
| 27 | 59.97 | 60.55 | 61.06 | 61.51 | 61.88 | 62.17 | 62.38 | 62.50 | 62.55 | 62.51 | 62.39 | 62.19 | 61.90 | 61.54 | 61.10 | 60.58 |
| 28 | 60.30 | 60.86 | 61.40 | 61.86 | 62.26 | 62.57 | 62.80 | 62.95 | 63.02 | 63.00 | 62.90 | 62.72 | 62.45 | 62.10 | 61.67 | 61.17 |
| 29 | 60.68 | 61.20 | 61.75 | 62.24 | 62.66 | 62.99 | 63.25 | 63.42 | 63.51 | 63.51 | 63.43 | 63.27 | 63.01 | 62.68 | 62.27 | 61.77 |
| 30 | 61.11 | 61.60 | 62.13 | 62.65 | 63.08 | 63.44 | 63.72 | 63.92 | 64.03 | 64.05 | 63.99 | 63.84 | 63.60 | 63.29 | 62.89 | 62.40 |
| 31 | 61.60 | 62.05 | 62.55 | 63.08 | 63.54 | 63.92 | 64.22 | 64.44 | 64.57 | 64.61 | 64.57 | 64.44 | 64.22 | 63.92 | 63.53 | 63.06 |
| 32 | 62.15 | 62.56 | 63.02 | 63.54 | 64.02 | 64.43 | 64.75 | 64.99 | 65.14 | 65.20 | 65.18 | 65.06 | 64.86 | 64.57 | 64.20 | 63.74 |

## Continued

|    |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
|----|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 33 | 62.75  | 63.13  | 63.56  | 64.03  | 64.53  | 64.96  | 65.31  | 65.57  | 65.74  | 65.82  | 65.82  | 65.72  | 65.54  | 65.26  | 64.90  | 64.45  |
| 34 | 63.42  | 63.76  | 64.15  | 64.59  | 65.08  | 65.53  | 65.90  | 66.18  | 66.37  | 66.48  | 66.49  | 66.41  | 66.24  | 65.98  | 65.63  | 65.19  |
| 35 | 64.14  | 64.45  | 64.80  | 65.21  | 65.67  | 66.14  | 66.53  | 66.83  | 67.04  | 67.16  | 67.19  | 67.13  | 66.98  | 66.73  | 66.39  | 65.96  |
| 36 | 64.93  | 65.20  | 65.52  | 65.89  | 66.32  | 66.79  | 67.19  | 67.52  | 67.75  | 67.89  | 67.94  | 67.89  | 67.75  | 67.52  | 67.19  | 66.77  |
| 37 | 65.78  | 66.02  | 66.30  | 66.64  | 67.03  | 67.48  | 67.91  | 68.25  | 68.50  | 68.66  | 68.72  | 68.69  | 68.57  | 68.34  | 68.03  | 67.62  |
| 38 | 66.70  | 66.90  | 67.15  | 67.46  | 67.82  | 68.23  | 68.66  | 69.02  | 69.29  | 69.47  | 69.55  | 69.54  | 69.42  | 69.21  | 68.91  | 68.51  |
| 39 | 67.68  | 67.85  | 68.07  | 68.35  | 68.67  | 69.05  | 69.47  | 69.85  | 70.14  | 70.33  | 70.43  | 70.43  | 70.33  | 70.13  | 69.83  | 69.44  |
| 40 | 68.74  | 68.88  | 69.07  | 69.31  | 69.60  | 69.94  | 70.34  | 70.73  | 71.04  | 71.24  | 71.36  | 71.37  | 71.28  | 71.09  | 70.80  | 70.41  |
| 41 | 69.87  | 69.97  | 70.13  | 70.34  | 70.60  | 70.91  | 71.28  | 71.68  | 71.99  | 72.22  | 72.34  | 72.36  | 72.29  | 72.11  | 71.83  | 71.44  |
| 42 | 71.08  | 71.15  | 71.27  | 71.45  | 71.68  | 71.97  | 72.30  | 72.69  | 73.02  | 73.25  | 73.39  | 73.42  | 73.35  | 73.18  | 72.90  | 72.52  |
| 43 | 72.36  | 72.40  | 72.50  | 72.65  | 72.85  | 73.10  | 73.41  | 73.77  | 74.11  | 74.36  | 74.50  | 74.55  | 74.48  | 74.32  | 74.05  | 73.67  |
| 44 | 73.73  | 73.74  | 73.81  | 73.93  | 74.10  | 74.32  | 74.60  | 74.94  | 75.28  | 75.54  | 75.69  | 75.74  | 75.69  | 75.52  | 75.25  | 74.87  |
| 45 | 75.19  | 75.17  | 75.21  | 75.30  | 75.44  | 75.64  | 75.89  | 76.20  | 76.54  | 76.80  | 76.96  | 77.01  | 76.96  | 76.80  | 76.53  | 76.15  |
| 46 | 76.73  | 76.69  | 76.70  | 76.76  | 76.88  | 77.05  | 77.28  | 77.56  | 77.88  | 78.15  | 78.31  | 78.37  | 78.32  | 78.16  | 77.89  | 77.50  |
| 47 | 78.38  | 78.31  | 78.29  | 78.33  | 78.42  | 78.57  | 78.77  | 79.02  | 79.33  | 79.60  | 79.76  | 79.82  | 79.77  | 79.61  | 79.33  | 78.94  |
| 48 | 80.12  | 80.03  | 79.99  | 80.00  | 80.07  | 80.19  | 80.37  | 80.60  | 80.89  | 81.16  | 81.32  | 81.37  | 81.32  | 81.15  | 80.86  | 80.46  |
| 49 | 81.98  | 81.86  | 81.80  | 81.79  | 81.83  | 81.93  | 82.09  | 82.31  | 82.57  | 82.83  | 82.99  | 83.03  | 82.97  | 82.79  | 82.49  | 82.08  |
| 50 | 83.95  | 83.81  | 83.72  | 83.69  | 83.72  | 83.80  | 83.94  | 84.14  | 84.39  | 84.63  | 84.78  | 84.82  | 84.74  | 84.55  | 84.24  | 83.80  |
| 51 | 86.05  | 85.89  | 85.78  | 85.73  | 85.74  | 85.81  | 85.93  | 86.11  | 86.35  | 86.58  | 86.71  | 86.73  | 86.64  | 86.43  | 86.10  | 85.64  |
| 52 | 88.28  | 88.10  | 87.98  | 87.92  | 87.91  | 87.96  | 88.07  | 88.24  | 88.46  | 88.67  | 88.79  | 88.79  | 88.67  | 88.44  | 88.08  | 87.60  |
| 53 | 90.65  | 90.46  | 90.33  | 90.25  | 90.24  | 90.28  | 90.38  | 90.53  | 90.75  | 90.94  | 91.03  | 91.00  | 90.86  | 90.60  | 90.21  | 89.70  |
| 54 | 93.19  | 92.99  | 92.84  | 92.76  | 92.74  | 92.77  | 92.86  | 93.02  | 93.22  | 93.38  | 93.44  | 93.39  | 93.21  | 92.92  | 92.50  | 91.94  |
| 55 | 95.90  | 95.69  | 95.54  | 95.46  | 95.43  | 95.46  | 95.56  | 95.71  | 95.91  | 96.03  | 96.05  | 95.96  | 95.75  | 95.41  | 94.94  | 94.35  |
| 56 | 98.80  | 98.59  | 98.45  | 98.36  | 98.34  | 98.38  | 98.48  | 98.63  | 98.81  | 98.89  | 98.87  | 98.73  | 98.47  | 98.09  | 97.57  | 96.92  |
| 57 | 101.91 | 101.72 | 101.58 | 101.51 | 101.50 | 101.55 | 101.66 | 101.83 | 101.96 | 101.99 | 101.92 | 101.73 | 101.42 | 100.97 | 100.40 | 99.69  |
| 58 | 105.28 | 105.10 | 104.98 | 104.93 | 104.94 | 105.01 | 105.14 | 105.30 | 105.38 | 105.35 | 105.22 | 104.97 | 104.59 | 104.09 | 103.44 | 102.66 |
| 59 | 108.93 | 108.78 | 108.69 | 108.67 | 108.71 | 108.81 | 108.97 | 109.08 | 109.09 | 109.00 | 108.80 | 108.47 | 108.02 | 107.44 | 106.72 | 105.85 |
| 60 | 112.91 | 112.80 | 112.76 | 112.79 | 112.87 | 113.02 | 113.15 | 113.18 | 113.12 | 112.95 | 112.67 | 112.27 | 111.73 | 111.06 | 110.25 | 109.28 |
| 61 | 117.31 | 117.26 | 117.28 | 117.37 | 117.52 | 117.65 | 117.69 | 117.65 | 117.50 | 117.25 | 116.88 | 116.38 | 115.75 | 114.98 | 114.06 | 112.98 |
| 62 | 122.21 | 122.26 | 122.37 | 122.54 | 122.65 | 122.69 | 122.65 | 122.51 | 122.27 | 121.92 | 121.45 | 120.84 | 120.10 | 119.21 | 118.17 | 116.97 |
| 63 | 127.81 | 127.98 | 128.13 | 128.23 | 128.25 | 128.19 | 128.05 | 127.81 | 127.46 | 127.00 | 126.41 | 125.68 | 124.81 | 123.79 | 122.61 | 121.27 |
| 64 | 134.27 | 134.39 | 134.45 | 134.45 | 134.37 | 134.21 | 133.96 | 133.60 | 133.13 | 132.54 | 131.81 | 130.95 | 129.93 | 128.76 | 127.42 | 125.91 |
| 65 | 141.40 | 141.42 | 141.38 | 141.27 | 141.08 | 140.80 | 140.42 | 139.93 | 139.32 | 138.58 | 137.70 | 136.67 | 135.49 | 134.14 | 132.62 | 130.92 |

**Table A2.** Minimum daily efficiencies (in percent) for latitudes [0°, 65°]; slope angles [16°, 30°].

|           | 16    | 17    | 18    | 19    | 20    | 21    | 22    | 23    | 24    | 25    | 26    | 27    | 28    | 29    | 30    |
|-----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| <b>0</b>  | 49.01 | 48.18 | 47.40 | 46.67 | 46.00 | 45.38 | 44.80 | 44.28 | 43.80 | 43.37 | 42.98 | 42.64 | 42.35 | 42.10 | 41.89 |
| <b>1</b>  | 49.29 | 48.41 | 47.59 | 46.82 | 46.11 | 45.44 | 44.83 | 44.26 | 43.74 | 43.27 | 42.85 | 42.47 | 42.14 | 41.85 | 41.60 |
| <b>2</b>  | 49.59 | 48.68 | 47.82 | 47.01 | 46.25 | 45.54 | 44.88 | 44.28 | 43.72 | 43.21 | 42.75 | 42.33 | 41.96 | 41.63 | 41.35 |
| <b>3</b>  | 49.89 | 49.00 | 48.09 | 47.23 | 46.43 | 45.68 | 44.98 | 44.33 | 43.74 | 43.19 | 42.68 | 42.23 | 41.82 | 41.45 | 41.13 |
| <b>4</b>  | 50.20 | 49.32 | 48.40 | 47.50 | 46.65 | 45.86 | 45.12 | 44.43 | 43.79 | 43.20 | 42.65 | 42.16 | 41.71 | 41.31 | 40.95 |
| <b>5</b>  | 50.52 | 49.65 | 48.74 | 47.80 | 46.91 | 46.07 | 45.29 | 44.56 | 43.88 | 43.24 | 42.66 | 42.13 | 41.64 | 41.20 | 40.80 |
| <b>6</b>  | 50.85 | 49.99 | 49.08 | 48.15 | 47.21 | 46.33 | 45.50 | 44.72 | 44.00 | 43.33 | 42.70 | 42.13 | 41.60 | 41.12 | 40.69 |
| <b>7</b>  | 51.18 | 50.33 | 49.44 | 48.51 | 47.55 | 46.62 | 45.75 | 44.93 | 44.16 | 43.45 | 42.78 | 42.17 | 41.60 | 41.08 | 40.61 |
| <b>8</b>  | 51.52 | 50.68 | 49.80 | 48.88 | 47.92 | 46.95 | 46.04 | 45.17 | 44.36 | 43.61 | 42.90 | 42.24 | 41.64 | 41.08 | 40.56 |
| <b>9</b>  | 51.87 | 51.04 | 50.16 | 49.25 | 48.31 | 47.33 | 46.36 | 45.45 | 44.60 | 43.80 | 43.05 | 42.35 | 41.70 | 41.11 | 40.55 |
| <b>10</b> | 52.23 | 51.41 | 50.54 | 49.64 | 48.70 | 47.72 | 46.73 | 45.77 | 44.87 | 44.03 | 43.24 | 42.50 | 41.81 | 41.17 | 40.58 |
| <b>11</b> | 52.60 | 51.78 | 50.93 | 50.03 | 49.09 | 48.13 | 47.13 | 46.13 | 45.19 | 44.30 | 43.46 | 42.68 | 41.95 | 41.27 | 40.63 |
| <b>12</b> | 52.97 | 52.17 | 51.32 | 50.43 | 49.50 | 48.54 | 47.55 | 46.53 | 45.54 | 44.60 | 43.72 | 42.90 | 42.12 | 41.40 | 40.73 |
| <b>13</b> | 53.35 | 52.56 | 51.72 | 50.84 | 49.92 | 48.96 | 47.97 | 46.96 | 45.93 | 44.94 | 44.02 | 43.15 | 42.33 | 41.57 | 40.85 |
| <b>14</b> | 53.75 | 52.96 | 52.13 | 51.26 | 50.34 | 49.39 | 48.41 | 47.39 | 46.36 | 45.33 | 44.35 | 43.44 | 42.58 | 41.77 | 41.01 |
| <b>15</b> | 54.15 | 53.38 | 52.55 | 51.69 | 50.78 | 49.83 | 48.85 | 47.84 | 46.80 | 45.74 | 44.72 | 43.76 | 42.86 | 42.00 | 41.20 |
| <b>16</b> | 54.56 | 53.80 | 52.99 | 52.13 | 51.22 | 50.28 | 49.30 | 48.30 | 47.26 | 46.20 | 45.13 | 44.12 | 43.17 | 42.28 | 41.43 |
| <b>17</b> | 54.99 | 54.23 | 53.43 | 52.58 | 51.68 | 50.74 | 49.77 | 48.76 | 47.73 | 46.66 | 45.58 | 44.52 | 43.52 | 42.58 | 41.69 |
| <b>18</b> | 55.42 | 54.68 | 53.88 | 53.04 | 52.15 | 51.21 | 50.24 | 49.24 | 48.20 | 47.14 | 46.06 | 44.96 | 43.91 | 42.92 | 41.99 |
| <b>19</b> | 55.87 | 55.14 | 54.35 | 53.51 | 52.63 | 51.70 | 50.73 | 49.73 | 48.69 | 47.63 | 46.54 | 45.43 | 44.34 | 43.30 | 42.32 |
| <b>20</b> | 56.33 | 55.61 | 54.83 | 54.00 | 53.12 | 52.19 | 51.23 | 50.23 | 49.19 | 48.13 | 47.04 | 45.93 | 44.80 | 43.72 | 42.69 |
| <b>21</b> | 56.81 | 56.09 | 55.32 | 54.50 | 53.62 | 52.70 | 51.74 | 50.74 | 49.70 | 48.64 | 47.55 | 46.43 | 45.30 | 44.17 | 43.09 |
| <b>22</b> | 57.30 | 56.59 | 55.83 | 55.01 | 54.14 | 53.22 | 52.26 | 51.26 | 50.23 | 49.16 | 48.07 | 46.95 | 45.81 | 44.65 | 43.53 |
| <b>23</b> | 57.80 | 57.11 | 56.35 | 55.54 | 54.67 | 53.76 | 52.80 | 51.80 | 50.77 | 49.70 | 48.60 | 47.48 | 46.33 | 45.17 | 44.00 |
| <b>24</b> | 58.32 | 57.64 | 56.89 | 56.08 | 55.22 | 54.31 | 53.36 | 52.36 | 51.32 | 50.25 | 49.15 | 48.02 | 46.87 | 45.70 | 44.51 |
| <b>25</b> | 58.86 | 58.18 | 57.44 | 56.64 | 55.79 | 54.88 | 53.92 | 52.92 | 51.89 | 50.81 | 49.71 | 48.57 | 47.42 | 46.24 | 45.05 |
| <b>26</b> | 59.42 | 58.75 | 58.02 | 57.22 | 56.37 | 55.46 | 54.51 | 53.51 | 52.47 | 51.39 | 50.28 | 49.14 | 47.98 | 46.80 | 45.59 |
| <b>27</b> | 59.99 | 59.33 | 58.61 | 57.82 | 56.97 | 56.07 | 55.11 | 54.11 | 53.07 | 51.99 | 50.87 | 49.73 | 48.56 | 47.36 | 46.15 |
| <b>28</b> | 60.59 | 59.94 | 59.22 | 58.43 | 57.59 | 56.69 | 55.73 | 54.73 | 53.69 | 52.60 | 51.48 | 50.33 | 49.15 | 47.95 | 46.73 |
| <b>29</b> | 61.20 | 60.56 | 59.85 | 59.07 | 58.23 | 57.33 | 56.37 | 55.37 | 54.32 | 53.23 | 52.10 | 50.94 | 49.76 | 48.55 | 47.31 |
| <b>30</b> | 61.84 | 61.21 | 60.50 | 59.73 | 58.89 | 57.99 | 57.04 | 56.03 | 54.98 | 53.88 | 52.75 | 51.58 | 50.38 | 49.16 | 47.92 |
| <b>31</b> | 62.51 | 61.88 | 61.18 | 60.41 | 59.57 | 58.68 | 57.72 | 56.71 | 55.65 | 54.55 | 53.41 | 52.23 | 51.03 | 49.79 | 48.54 |
| <b>32</b> | 63.20 | 62.58 | 61.89 | 61.12 | 60.28 | 59.39 | 58.43 | 57.41 | 56.35 | 55.24 | 54.09 | 52.91 | 51.69 | 50.44 | 49.17 |

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|    |        |        |        |        |        |        |        |        |        |        |        |       |       |       |       |
|----|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|-------|-------|-------|
| 33 | 63.92  | 63.31  | 62.62  | 61.85  | 61.02  | 60.12  | 59.16  | 58.14  | 57.07  | 55.96  | 54.80  | 53.60 | 52.37 | 51.11 | 49.83 |
| 34 | 64.67  | 64.06  | 63.38  | 62.62  | 61.78  | 60.88  | 59.92  | 58.89  | 57.82  | 56.69  | 55.52  | 54.31 | 53.07 | 51.80 | 50.50 |
| 35 | 65.45  | 64.85  | 64.17  | 63.41  | 62.58  | 61.67  | 60.70  | 59.67  | 58.59  | 57.46  | 56.27  | 55.05 | 53.80 | 52.51 | 51.19 |
| 36 | 66.26  | 65.67  | 64.99  | 64.23  | 63.40  | 62.49  | 61.52  | 60.48  | 59.39  | 58.24  | 57.05  | 55.82 | 54.54 | 53.24 | 51.91 |
| 37 | 67.12  | 66.53  | 65.85  | 65.09  | 64.26  | 63.35  | 62.37  | 61.32  | 60.22  | 59.06  | 57.86  | 56.61 | 55.32 | 53.99 | 52.64 |
| 38 | 68.01  | 67.42  | 66.75  | 65.99  | 65.15  | 64.24  | 63.25  | 62.20  | 61.08  | 59.91  | 58.69  | 57.42 | 56.12 | 54.77 | 53.40 |
| 39 | 68.95  | 68.36  | 67.69  | 66.93  | 66.08  | 65.16  | 64.17  | 63.10  | 61.97  | 60.79  | 59.55  | 58.27 | 56.94 | 55.58 | 54.19 |
| 40 | 69.93  | 69.34  | 68.67  | 67.91  | 67.06  | 66.13  | 65.12  | 64.05  | 62.90  | 61.70  | 60.45  | 59.14 | 57.80 | 56.41 | 55.00 |
| 41 | 70.96  | 70.38  | 69.70  | 68.93  | 68.08  | 67.14  | 66.12  | 65.03  | 63.87  | 62.65  | 61.38  | 60.05 | 58.68 | 57.28 | 55.84 |
| 42 | 72.04  | 71.46  | 70.78  | 70.00  | 69.14  | 68.19  | 67.16  | 66.06  | 64.88  | 63.64  | 62.35  | 61.00 | 59.60 | 58.17 | 56.70 |
| 43 | 73.18  | 72.60  | 71.91  | 71.13  | 70.26  | 69.29  | 68.25  | 67.13  | 65.93  | 64.67  | 63.35  | 61.98 | 60.56 | 59.10 | 57.60 |
| 44 | 74.39  | 73.80  | 73.11  | 72.31  | 71.43  | 70.45  | 69.39  | 68.25  | 67.03  | 65.74  | 64.40  | 63.00 | 61.55 | 60.06 | 58.53 |
| 45 | 75.66  | 75.06  | 74.36  | 73.56  | 72.66  | 71.66  | 70.58  | 69.42  | 68.17  | 66.86  | 65.49  | 64.06 | 62.58 | 61.05 | 59.49 |
| 46 | 77.01  | 76.40  | 75.69  | 74.87  | 73.95  | 72.94  | 71.83  | 70.64  | 69.37  | 68.03  | 66.63  | 65.16 | 63.65 | 62.09 | 60.49 |
| 47 | 78.43  | 77.81  | 77.08  | 76.25  | 75.31  | 74.27  | 73.14  | 71.93  | 70.63  | 69.26  | 67.82  | 66.32 | 64.76 | 63.16 | 61.52 |
| 48 | 79.94  | 79.31  | 78.56  | 77.71  | 76.74  | 75.68  | 74.52  | 73.27  | 71.94  | 70.53  | 69.06  | 67.52 | 65.92 | 64.28 | 62.60 |
| 49 | 81.54  | 80.89  | 80.13  | 79.24  | 78.26  | 77.16  | 75.97  | 74.69  | 73.32  | 71.87  | 70.35  | 68.77 | 67.13 | 65.44 | 63.71 |
| 50 | 83.25  | 82.57  | 81.78  | 80.87  | 79.85  | 78.73  | 77.50  | 76.17  | 74.76  | 73.27  | 71.71  | 70.07 | 68.39 | 66.65 | 64.87 |
| 51 | 85.06  | 84.36  | 83.54  | 82.60  | 81.54  | 80.38  | 79.11  | 77.74  | 76.28  | 74.74  | 73.12  | 71.44 | 69.70 | 67.90 | 66.07 |
| 52 | 87.00  | 86.26  | 85.40  | 84.43  | 83.33  | 82.12  | 80.80  | 79.39  | 77.88  | 76.28  | 74.61  | 72.87 | 71.07 | 69.21 | 67.32 |
| 53 | 89.06  | 88.29  | 87.39  | 86.37  | 85.22  | 83.96  | 82.59  | 81.12  | 79.55  | 77.90  | 76.16  | 74.36 | 72.49 | 70.57 | 68.61 |
| 54 | 91.26  | 90.44  | 89.50  | 88.43  | 87.23  | 85.91  | 84.48  | 82.95  | 81.32  | 79.60  | 77.79  | 75.92 | 73.98 | 71.99 | 69.96 |
| 55 | 93.61  | 92.75  | 91.75  | 90.62  | 89.36  | 87.98  | 86.48  | 84.88  | 83.18  | 81.38  | 79.50  | 77.55 | 75.54 | 73.47 | 71.35 |
| 56 | 96.13  | 95.21  | 94.15  | 92.95  | 91.62  | 90.17  | 88.60  | 86.92  | 85.13  | 83.25  | 81.29  | 79.26 | 77.16 | 75.00 | 72.80 |
| 57 | 98.83  | 97.84  | 96.70  | 95.43  | 94.03  | 92.49  | 90.84  | 89.07  | 87.19  | 85.22  | 83.17  | 81.04 | 78.85 | 76.60 | 74.30 |
| 58 | 101.73 | 100.65 | 99.44  | 98.08  | 96.59  | 94.96  | 93.21  | 91.34  | 89.37  | 87.30  | 85.14  | 82.90 | 80.61 | 78.25 | 75.86 |
| 59 | 104.83 | 103.67 | 102.36 | 100.91 | 99.31  | 97.58  | 95.72  | 93.74  | 91.66  | 89.47  | 87.20  | 84.85 | 82.44 | 79.97 | 77.47 |
| 60 | 108.17 | 106.90 | 105.49 | 103.92 | 102.21 | 100.36 | 98.38  | 96.28  | 94.07  | 91.76  | 89.36  | 86.88 | 84.35 | 81.75 | 79.13 |
| 61 | 111.76 | 110.37 | 108.83 | 107.14 | 105.30 | 103.32 | 101.20 | 98.96  | 96.61  | 94.16  | 91.62  | 89.00 | 86.32 | 83.60 | 80.83 |
| 62 | 115.61 | 114.09 | 112.41 | 110.58 | 108.59 | 106.46 | 104.19 | 101.79 | 99.28  | 96.67  | 93.98  | 91.20 | 88.37 | 85.49 | 82.58 |
| 63 | 119.76 | 118.09 | 116.25 | 114.25 | 112.10 | 109.79 | 107.35 | 104.78 | 102.09 | 99.31  | 96.44  | 93.49 | 90.49 | 87.44 | 84.37 |
| 64 | 124.23 | 122.38 | 120.36 | 118.18 | 115.83 | 113.33 | 110.69 | 107.93 | 105.04 | 102.06 | 98.99  | 95.86 | 92.67 | 89.44 | 86.19 |
| 65 | 129.05 | 127.00 | 124.77 | 122.37 | 119.81 | 117.09 | 114.23 | 111.24 | 108.13 | 104.93 | 101.64 | 98.29 | 94.90 | 91.47 | 88.02 |

**Table A3.** Minimum daily efficiencies (in percent) for latitudes [0°, 65°]; slope angles [31°, 45°].

|           | 31    | 32    | 33    | 34    | 35    | 36    | 37    | 38    | 39    | 40    | 41    | 42    | 43    | 44    | 45    |
|-----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| <b>0</b>  | 41.73 | 41.61 | 41.53 | 41.50 | 41.51 | 41.56 | 41.66 | 41.80 | 41.98 | 42.21 | 42.48 | 42.80 | 43.16 | 43.56 | 44.02 |
| <b>1</b>  | 41.40 | 41.25 | 41.13 | 41.06 | 41.03 | 41.05 | 41.11 | 41.21 | 41.35 | 41.54 | 41.77 | 42.05 | 42.37 | 42.74 | 43.15 |
| <b>2</b>  | 41.11 | 40.92 | 40.77 | 40.66 | 40.59 | 40.57 | 40.59 | 40.66 | 40.76 | 40.91 | 41.11 | 41.34 | 41.62 | 41.95 | 42.32 |
| <b>3</b>  | 40.86 | 40.63 | 40.44 | 40.29 | 40.19 | 40.13 | 40.11 | 40.14 | 40.21 | 40.32 | 40.48 | 40.67 | 40.91 | 41.20 | 41.53 |
| <b>4</b>  | 40.64 | 40.37 | 40.14 | 39.96 | 39.82 | 39.72 | 39.67 | 39.66 | 39.69 | 39.76 | 39.88 | 40.04 | 40.24 | 40.49 | 40.78 |
| <b>5</b>  | 40.45 | 40.14 | 39.88 | 39.66 | 39.49 | 39.35 | 39.26 | 39.21 | 39.21 | 39.24 | 39.32 | 39.44 | 39.61 | 39.82 | 40.07 |
| <b>6</b>  | 40.30 | 39.96 | 39.65 | 39.40 | 39.18 | 39.01 | 38.89 | 38.80 | 38.76 | 38.76 | 38.80 | 38.88 | 39.01 | 39.18 | 39.39 |
| <b>7</b>  | 40.18 | 39.80 | 39.46 | 39.17 | 38.92 | 38.71 | 38.55 | 38.42 | 38.34 | 38.31 | 38.31 | 38.36 | 38.45 | 38.58 | 38.75 |
| <b>8</b>  | 40.10 | 39.68 | 39.30 | 38.97 | 38.68 | 38.44 | 38.24 | 38.08 | 37.96 | 37.89 | 37.86 | 37.87 | 37.92 | 38.01 | 38.15 |
| <b>9</b>  | 40.05 | 39.59 | 39.18 | 38.81 | 38.48 | 38.20 | 37.96 | 37.77 | 37.61 | 37.50 | 37.43 | 37.41 | 37.42 | 37.48 | 37.58 |
| <b>10</b> | 40.03 | 39.54 | 39.08 | 38.68 | 38.31 | 38.00 | 37.72 | 37.49 | 37.30 | 37.15 | 37.05 | 36.98 | 36.96 | 36.98 | 37.04 |
| <b>11</b> | 40.05 | 39.51 | 39.02 | 38.58 | 38.18 | 37.82 | 37.51 | 37.24 | 37.01 | 36.83 | 36.69 | 36.59 | 36.53 | 36.51 | 36.54 |
| <b>12</b> | 40.10 | 39.53 | 39.00 | 38.51 | 38.08 | 37.68 | 37.33 | 37.03 | 36.76 | 36.54 | 36.36 | 36.23 | 36.13 | 36.08 | 36.07 |
| <b>13</b> | 40.19 | 39.57 | 39.00 | 38.48 | 38.00 | 37.57 | 37.19 | 36.84 | 36.54 | 36.29 | 36.07 | 35.90 | 35.77 | 35.68 | 35.63 |
| <b>14</b> | 40.30 | 39.65 | 39.04 | 38.48 | 37.96 | 37.49 | 37.07 | 36.69 | 36.35 | 36.06 | 35.81 | 35.60 | 35.43 | 35.31 | 35.22 |
| <b>15</b> | 40.46 | 39.76 | 39.11 | 38.51 | 37.96 | 37.45 | 36.99 | 36.57 | 36.20 | 35.87 | 35.58 | 35.33 | 35.13 | 34.97 | 34.85 |
| <b>16</b> | 40.64 | 39.90 | 39.21 | 38.57 | 37.98 | 37.43 | 36.93 | 36.48 | 36.07 | 35.70 | 35.38 | 35.09 | 34.86 | 34.66 | 34.50 |
| <b>17</b> | 40.86 | 40.08 | 39.35 | 38.67 | 38.04 | 37.45 | 36.91 | 36.42 | 35.97 | 35.57 | 35.21 | 34.89 | 34.61 | 34.38 | 34.19 |
| <b>18</b> | 41.11 | 40.29 | 39.52 | 38.79 | 38.12 | 37.50 | 36.92 | 36.39 | 35.90 | 35.46 | 35.06 | 34.71 | 34.40 | 34.13 | 33.90 |
| <b>19</b> | 41.40 | 40.53 | 39.72 | 38.95 | 38.24 | 37.58 | 36.96 | 36.39 | 35.86 | 35.39 | 34.95 | 34.56 | 34.21 | 33.91 | 33.64 |
| <b>20</b> | 41.72 | 40.81 | 39.95 | 39.14 | 38.39 | 37.68 | 37.03 | 36.42 | 35.86 | 35.34 | 34.87 | 34.44 | 34.06 | 33.71 | 33.42 |
| <b>21</b> | 42.08 | 41.12 | 40.22 | 39.37 | 38.57 | 37.82 | 37.13 | 36.48 | 35.88 | 35.32 | 34.81 | 34.35 | 33.93 | 33.55 | 33.22 |
| <b>22</b> | 42.47 | 41.46 | 40.52 | 39.62 | 38.78 | 37.99 | 37.26 | 36.57 | 35.93 | 35.33 | 34.79 | 34.29 | 33.83 | 33.41 | 33.04 |
| <b>23</b> | 42.89 | 41.84 | 40.85 | 39.91 | 39.03 | 38.20 | 37.42 | 36.69 | 36.01 | 35.38 | 34.79 | 34.25 | 33.76 | 33.30 | 32.90 |
| <b>24</b> | 43.35 | 42.25 | 41.21 | 40.23 | 39.30 | 38.43 | 37.61 | 36.84 | 36.12 | 35.44 | 34.82 | 34.24 | 33.71 | 33.22 | 32.78 |
| <b>25</b> | 43.85 | 42.70 | 41.61 | 40.58 | 39.61 | 38.69 | 37.82 | 37.01 | 36.25 | 35.54 | 34.88 | 34.26 | 33.69 | 33.17 | 32.69 |
| <b>26</b> | 44.38 | 43.18 | 42.04 | 40.96 | 39.94 | 38.98 | 38.07 | 37.22 | 36.42 | 35.67 | 34.96 | 34.31 | 33.70 | 33.14 | 32.62 |
| <b>27</b> | 44.93 | 43.69 | 42.50 | 41.38 | 40.31 | 39.30 | 38.35 | 37.46 | 36.61 | 35.82 | 35.08 | 34.38 | 33.74 | 33.14 | 32.58 |
| <b>28</b> | 45.49 | 44.24 | 43.00 | 41.83 | 40.71 | 39.66 | 38.66 | 37.72 | 36.83 | 36.00 | 35.22 | 34.48 | 33.80 | 33.16 | 32.57 |
| <b>29</b> | 46.06 | 44.80 | 43.54 | 42.31 | 41.15 | 40.04 | 39.00 | 38.01 | 37.08 | 36.21 | 35.38 | 34.61 | 33.88 | 33.21 | 32.58 |
| <b>30</b> | 46.66 | 45.38 | 44.10 | 42.82 | 41.61 | 40.46 | 39.37 | 38.34 | 37.36 | 36.44 | 35.58 | 34.76 | 34.00 | 33.28 | 32.61 |
| <b>31</b> | 47.26 | 45.97 | 44.67 | 43.37 | 42.10 | 40.90 | 39.77 | 38.69 | 37.67 | 36.70 | 35.79 | 34.94 | 34.13 | 33.38 | 32.67 |
| <b>32</b> | 47.88 | 46.58 | 45.27 | 43.94 | 42.63 | 41.38 | 40.19 | 39.07 | 38.00 | 36.99 | 36.04 | 35.14 | 34.29 | 33.50 | 32.75 |



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|    |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 33 | 48.52 | 47.20 | 45.87 | 44.53 | 43.19 | 41.89 | 40.65 | 39.47 | 38.36 | 37.31 | 36.31 | 35.37 | 34.48 | 33.65 | 32.86 |
| 34 | 49.18 | 47.84 | 46.50 | 45.14 | 43.78 | 42.42 | 41.13 | 39.91 | 38.75 | 37.65 | 36.61 | 35.62 | 34.69 | 33.82 | 32.99 |
| 35 | 49.86 | 48.50 | 47.14 | 45.76 | 44.38 | 42.99 | 41.65 | 40.37 | 39.16 | 38.02 | 36.93 | 35.90 | 34.93 | 34.01 | 33.14 |
| 36 | 50.55 | 49.18 | 47.79 | 46.40 | 44.99 | 43.59 | 42.19 | 40.87 | 39.61 | 38.41 | 37.28 | 36.20 | 35.18 | 34.22 | 33.31 |
| 37 | 51.27 | 49.88 | 48.47 | 47.05 | 45.62 | 44.19 | 42.77 | 41.39 | 40.07 | 38.83 | 37.65 | 36.53 | 35.46 | 34.46 | 33.51 |
| 38 | 52.01 | 50.59 | 49.16 | 47.72 | 46.27 | 44.82 | 43.37 | 41.93 | 40.57 | 39.27 | 38.04 | 36.87 | 35.77 | 34.72 | 33.72 |
| 39 | 52.77 | 51.33 | 49.88 | 48.41 | 46.94 | 45.46 | 43.98 | 42.51 | 41.09 | 39.74 | 38.46 | 37.24 | 36.09 | 35.00 | 33.96 |
| 40 | 53.56 | 52.09 | 50.61 | 49.12 | 47.62 | 46.11 | 44.61 | 43.11 | 41.63 | 40.23 | 38.90 | 37.64 | 36.43 | 35.30 | 34.22 |
| 41 | 54.37 | 52.88 | 51.37 | 49.85 | 48.32 | 46.79 | 45.25 | 43.72 | 42.20 | 40.75 | 39.36 | 38.05 | 36.80 | 35.61 | 34.49 |
| 42 | 55.21 | 53.69 | 52.15 | 50.60 | 49.04 | 47.48 | 45.91 | 44.35 | 42.80 | 41.29 | 39.85 | 38.48 | 37.18 | 35.95 | 34.78 |
| 43 | 56.07 | 54.52 | 52.95 | 51.37 | 49.78 | 48.18 | 46.59 | 45.00 | 43.41 | 41.85 | 40.35 | 38.94 | 37.59 | 36.31 | 35.09 |
| 44 | 56.97 | 55.39 | 53.78 | 52.17 | 50.54 | 48.91 | 47.28 | 45.65 | 44.03 | 42.43 | 40.88 | 39.41 | 38.01 | 36.68 | 35.41 |
| 45 | 57.90 | 56.28 | 54.64 | 52.99 | 51.32 | 49.66 | 47.99 | 46.33 | 44.67 | 43.03 | 41.42 | 39.90 | 38.44 | 37.06 | 35.75 |
| 46 | 58.86 | 57.20 | 55.52 | 53.83 | 52.13 | 50.42 | 48.72 | 47.02 | 45.32 | 43.64 | 41.99 | 40.40 | 38.90 | 37.46 | 36.10 |
| 47 | 59.85 | 58.15 | 56.43 | 54.70 | 52.96 | 51.21 | 49.46 | 47.72 | 45.99 | 44.27 | 42.56 | 40.92 | 39.36 | 37.88 | 36.47 |
| 48 | 60.88 | 59.14 | 57.37 | 55.59 | 53.81 | 52.01 | 50.22 | 48.44 | 46.66 | 44.90 | 43.16 | 41.46 | 39.84 | 38.30 | 36.84 |
| 49 | 61.95 | 60.15 | 58.34 | 56.52 | 54.68 | 52.84 | 51.00 | 49.17 | 47.35 | 45.55 | 43.76 | 42.00 | 40.33 | 38.74 | 37.22 |
| 50 | 63.05 | 61.21 | 59.34 | 57.47 | 55.58 | 53.69 | 51.80 | 49.92 | 48.05 | 46.20 | 44.37 | 42.56 | 40.83 | 39.18 | 37.61 |
| 51 | 64.20 | 62.30 | 60.38 | 58.44 | 56.50 | 54.56 | 52.62 | 50.68 | 48.76 | 46.86 | 44.98 | 43.12 | 41.33 | 39.62 | 38.00 |
| 52 | 65.38 | 63.42 | 61.44 | 59.45 | 57.45 | 55.45 | 53.45 | 51.46 | 49.49 | 47.53 | 45.60 | 43.69 | 41.84 | 40.07 | 38.39 |
| 53 | 66.61 | 64.59 | 62.54 | 60.48 | 58.42 | 56.35 | 54.30 | 52.25 | 50.22 | 48.20 | 46.22 | 44.25 | 42.34 | 40.52 | 38.79 |
| 54 | 67.89 | 65.79 | 63.67 | 61.55 | 59.41 | 57.28 | 55.16 | 53.05 | 50.95 | 48.88 | 46.84 | 44.82 | 42.85 | 40.97 | 39.17 |
| 55 | 69.21 | 67.03 | 64.84 | 62.64 | 60.43 | 58.23 | 56.03 | 53.85 | 51.69 | 49.56 | 47.45 | 45.38 | 43.34 | 41.40 | 39.55 |
| 56 | 70.57 | 68.31 | 66.04 | 63.75 | 61.47 | 59.19 | 56.92 | 54.67 | 52.44 | 50.23 | 48.06 | 45.93 | 43.83 | 41.83 | 39.92 |
| 57 | 71.98 | 69.63 | 67.26 | 64.89 | 62.52 | 60.16 | 57.81 | 55.48 | 53.18 | 50.90 | 48.66 | 46.46 | 44.30 | 42.24 | 40.27 |
| 58 | 73.43 | 70.98 | 68.52 | 66.05 | 63.59 | 61.14 | 58.70 | 56.29 | 53.91 | 51.56 | 49.25 | 46.98 | 44.75 | 42.62 | 40.60 |
| 59 | 74.93 | 72.37 | 69.80 | 67.24 | 64.67 | 62.13 | 59.60 | 57.10 | 54.63 | 52.20 | 49.82 | 47.47 | 45.18 | 42.98 | 40.90 |
| 60 | 76.47 | 73.79 | 71.11 | 68.43 | 65.76 | 63.11 | 60.49 | 57.89 | 55.34 | 52.82 | 50.35 | 47.93 | 45.57 | 43.31 | 41.16 |
| 61 | 78.04 | 75.24 | 72.43 | 69.64 | 66.85 | 64.09 | 61.36 | 58.67 | 56.02 | 53.41 | 50.86 | 48.35 | 45.92 | 43.59 | 41.39 |
| 62 | 79.65 | 76.71 | 73.77 | 70.84 | 67.93 | 65.05 | 62.21 | 59.41 | 56.66 | 53.96 | 51.31 | 48.72 | 46.21 | 43.83 | 41.56 |
| 63 | 81.28 | 78.19 | 75.10 | 72.03 | 68.99 | 65.99 | 63.03 | 60.11 | 57.25 | 54.45 | 51.71 | 49.03 | 46.45 | 44.00 | 41.67 |
| 64 | 82.93 | 79.67 | 76.42 | 73.20 | 70.02 | 66.88 | 63.79 | 60.76 | 57.78 | 54.88 | 52.04 | 49.27 | 46.62 | 44.10 | 41.72 |
| 65 | 84.57 | 81.13 | 77.72 | 74.34 | 71.00 | 67.72 | 64.49 | 61.33 | 58.24 | 55.22 | 52.28 | 49.42 | 46.70 | 44.12 | 41.68 |

**Table A4.** Minimum daily efficiencies (in percent) for latitudes [0°, 65°]; slope angles [46°, 60°].

|    | 46    | 47    | 48    | 49    | 50    | 51    | 52    | 53    | 54    | 55    | 56    | 57    | 58    | 59    | 60    |
|----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 0  | 44.52 | 45.06 | 45.66 | 46.31 | 47.00 | 47.75 | 48.55 | 49.41 | 50.32 | 51.29 | 52.32 | 53.41 | 54.57 | 55.79 | 57.07 |
| 1  | 43.60 | 44.11 | 44.66 | 45.26 | 45.91 | 46.61 | 47.37 | 48.17 | 49.03 | 49.95 | 50.92 | 51.96 | 53.05 | 54.21 | 55.43 |
| 2  | 42.73 | 43.20 | 43.70 | 44.26 | 44.87 | 45.52 | 46.23 | 46.98 | 47.79 | 48.66 | 49.58 | 50.56 | 51.60 | 52.70 | 53.86 |
| 3  | 41.90 | 42.32 | 42.79 | 43.30 | 43.86 | 44.47 | 45.13 | 45.84 | 46.60 | 47.42 | 48.29 | 49.21 | 50.19 | 51.24 | 52.34 |
| 4  | 41.11 | 41.49 | 41.92 | 42.39 | 42.90 | 43.47 | 44.08 | 44.75 | 45.46 | 46.23 | 47.04 | 47.92 | 48.85 | 49.83 | 50.88 |
| 5  | 40.36 | 40.70 | 41.08 | 41.51 | 41.99 | 42.51 | 43.08 | 43.69 | 44.36 | 45.08 | 45.85 | 46.67 | 47.55 | 48.48 | 49.47 |
| 6  | 39.65 | 39.95 | 40.29 | 40.68 | 41.11 | 41.59 | 42.11 | 42.69 | 43.31 | 43.98 | 44.70 | 45.47 | 46.30 | 47.18 | 48.12 |
| 7  | 38.97 | 39.23 | 39.53 | 39.88 | 40.27 | 40.71 | 41.19 | 41.72 | 42.30 | 42.92 | 43.60 | 44.32 | 45.10 | 45.93 | 46.82 |
| 8  | 38.33 | 38.55 | 38.81 | 39.12 | 39.47 | 39.87 | 40.31 | 40.79 | 41.33 | 41.91 | 42.54 | 43.22 | 43.95 | 44.73 | 45.56 |
| 9  | 37.72 | 37.90 | 38.13 | 38.39 | 38.71 | 39.06 | 39.46 | 39.91 | 40.40 | 40.94 | 41.52 | 42.16 | 42.84 | 43.57 | 44.36 |
| 10 | 37.14 | 37.29 | 37.48 | 37.71 | 37.98 | 38.30 | 38.66 | 39.06 | 39.51 | 40.01 | 40.55 | 41.14 | 41.77 | 42.46 | 43.20 |
| 11 | 36.60 | 36.71 | 36.86 | 37.05 | 37.29 | 37.57 | 37.89 | 38.25 | 38.66 | 39.11 | 39.61 | 40.16 | 40.75 | 41.39 | 42.08 |
| 12 | 36.10 | 36.17 | 36.28 | 36.44 | 36.63 | 36.87 | 37.15 | 37.48 | 37.85 | 38.26 | 38.72 | 39.22 | 39.77 | 40.37 | 41.01 |
| 13 | 35.62 | 35.66 | 35.73 | 35.85 | 36.01 | 36.21 | 36.45 | 36.74 | 37.07 | 37.44 | 37.86 | 38.32 | 38.83 | 39.38 | 39.98 |
| 14 | 35.18 | 35.18 | 35.22 | 35.30 | 35.42 | 35.58 | 35.79 | 36.04 | 36.33 | 36.66 | 37.04 | 37.46 | 37.92 | 38.43 | 38.99 |
| 15 | 34.77 | 34.73 | 34.73 | 34.78 | 34.86 | 34.99 | 35.16 | 35.37 | 35.62 | 35.91 | 36.25 | 36.63 | 37.06 | 37.53 | 38.04 |
| 16 | 34.39 | 34.31 | 34.28 | 34.29 | 34.34 | 34.43 | 34.56 | 34.73 | 34.95 | 35.20 | 35.50 | 35.84 | 36.23 | 36.65 | 37.13 |
| 17 | 34.04 | 33.93 | 33.86 | 33.83 | 33.84 | 33.90 | 33.99 | 34.13 | 34.31 | 34.52 | 34.78 | 35.09 | 35.43 | 35.82 | 36.25 |
| 18 | 33.71 | 33.57 | 33.47 | 33.40 | 33.38 | 33.40 | 33.46 | 33.56 | 33.70 | 33.88 | 34.10 | 34.36 | 34.67 | 35.02 | 35.41 |
| 19 | 33.42 | 33.24 | 33.10 | 33.00 | 32.94 | 32.93 | 32.95 | 33.01 | 33.12 | 33.26 | 33.45 | 33.68 | 33.94 | 34.25 | 34.61 |
| 20 | 33.16 | 32.94 | 32.77 | 32.63 | 32.54 | 32.49 | 32.47 | 32.50 | 32.57 | 32.68 | 32.83 | 33.02 | 33.25 | 33.52 | 33.84 |
| 21 | 32.92 | 32.67 | 32.46 | 32.29 | 32.16 | 32.07 | 32.03 | 32.02 | 32.05 | 32.12 | 32.24 | 32.39 | 32.58 | 32.82 | 33.10 |
| 22 | 32.71 | 32.43 | 32.18 | 31.98 | 31.81 | 31.69 | 31.61 | 31.56 | 31.56 | 31.60 | 31.68 | 31.79 | 31.95 | 32.15 | 32.39 |
| 23 | 32.53 | 32.21 | 31.93 | 31.69 | 31.49 | 31.33 | 31.21 | 31.14 | 31.10 | 31.10 | 31.14 | 31.23 | 31.35 | 31.51 | 31.71 |
| 24 | 32.38 | 32.02 | 31.70 | 31.43 | 31.20 | 31.00 | 30.85 | 30.74 | 30.66 | 30.63 | 30.64 | 30.69 | 30.77 | 30.90 | 31.07 |
| 25 | 32.25 | 31.86 | 31.50 | 31.20 | 30.93 | 30.70 | 30.51 | 30.36 | 30.26 | 30.19 | 30.16 | 30.17 | 30.23 | 30.32 | 30.45 |
| 26 | 32.15 | 31.72 | 31.33 | 30.99 | 30.68 | 30.42 | 30.20 | 30.02 | 29.88 | 29.77 | 29.71 | 29.69 | 29.71 | 29.76 | 29.86 |
| 27 | 32.07 | 31.61 | 31.18 | 30.80 | 30.46 | 30.17 | 29.91 | 29.69 | 29.52 | 29.38 | 29.29 | 29.23 | 29.21 | 29.23 | 29.30 |
| 28 | 32.02 | 31.52 | 31.06 | 30.64 | 30.27 | 29.94 | 29.65 | 29.40 | 29.19 | 29.02 | 28.89 | 28.80 | 28.74 | 28.73 | 28.76 |
| 29 | 31.99 | 31.45 | 30.96 | 30.51 | 30.10 | 29.73 | 29.41 | 29.12 | 28.88 | 28.68 | 28.51 | 28.39 | 28.30 | 28.25 | 28.25 |
| 30 | 31.99 | 31.42 | 30.88 | 30.40 | 29.95 | 29.55 | 29.19 | 28.87 | 28.59 | 28.36 | 28.16 | 28.00 | 27.88 | 27.80 | 27.76 |
| 31 | 32.01 | 31.40 | 30.83 | 30.31 | 29.83 | 29.39 | 29.00 | 28.65 | 28.33 | 28.06 | 27.83 | 27.64 | 27.48 | 27.37 | 27.30 |
| 32 | 32.06 | 31.41 | 30.80 | 30.24 | 29.73 | 29.26 | 28.83 | 28.44 | 28.09 | 27.79 | 27.52 | 27.30 | 27.11 | 26.96 | 26.86 |

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|    |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 33 | 32.12 | 31.44 | 30.79 | 30.20 | 29.65 | 29.14 | 28.68 | 28.25 | 27.87 | 27.53 | 27.24 | 26.98 | 26.76 | 26.58 | 26.44 |
| 34 | 32.21 | 31.49 | 30.81 | 30.18 | 29.59 | 29.05 | 28.55 | 28.09 | 27.68 | 27.30 | 26.97 | 26.68 | 26.43 | 26.21 | 26.04 |
| 35 | 32.33 | 31.56 | 30.84 | 30.17 | 29.55 | 28.97 | 28.44 | 27.95 | 27.50 | 27.09 | 26.72 | 26.40 | 26.11 | 25.87 | 25.66 |
| 36 | 32.46 | 31.65 | 30.90 | 30.19 | 29.53 | 28.92 | 28.35 | 27.82 | 27.34 | 26.90 | 26.50 | 26.14 | 25.82 | 25.54 | 25.30 |
| 37 | 32.61 | 31.77 | 30.97 | 30.23 | 29.53 | 28.88 | 28.28 | 27.71 | 27.20 | 26.72 | 26.29 | 25.90 | 25.54 | 25.23 | 24.96 |
| 38 | 32.79 | 31.90 | 31.07 | 30.29 | 29.55 | 28.86 | 28.22 | 27.62 | 27.07 | 26.56 | 26.10 | 25.67 | 25.29 | 24.94 | 24.64 |
| 39 | 32.98 | 32.05 | 31.18 | 30.36 | 29.59 | 28.86 | 28.18 | 27.55 | 26.96 | 26.42 | 25.92 | 25.46 | 25.04 | 24.67 | 24.33 |
| 40 | 33.19 | 32.23 | 31.31 | 30.45 | 29.64 | 28.88 | 28.16 | 27.50 | 26.87 | 26.29 | 25.76 | 25.27 | 24.82 | 24.41 | 24.04 |
| 41 | 33.42 | 32.41 | 31.46 | 30.56 | 29.71 | 28.91 | 28.16 | 27.45 | 26.80 | 26.18 | 25.61 | 25.09 | 24.60 | 24.16 | 23.76 |
| 42 | 33.67 | 32.62 | 31.62 | 30.68 | 29.79 | 28.95 | 28.17 | 27.42 | 26.73 | 26.08 | 25.48 | 24.92 | 24.40 | 23.93 | 23.50 |
| 43 | 33.93 | 32.84 | 31.80 | 30.82 | 29.89 | 29.01 | 28.19 | 27.41 | 26.68 | 26.00 | 25.36 | 24.77 | 24.22 | 23.71 | 23.24 |
| 44 | 34.21 | 33.07 | 31.99 | 30.97 | 30.00 | 29.08 | 28.22 | 27.41 | 26.64 | 25.92 | 25.25 | 24.62 | 24.04 | 23.50 | 23.00 |
| 45 | 34.50 | 33.32 | 32.19 | 31.13 | 30.12 | 29.16 | 28.26 | 27.41 | 26.61 | 25.86 | 25.15 | 24.49 | 23.87 | 23.30 | 22.77 |
| 46 | 34.81 | 33.58 | 32.41 | 31.30 | 30.25 | 29.26 | 28.31 | 27.43 | 26.59 | 25.80 | 25.06 | 24.36 | 23.71 | 23.11 | 22.54 |
| 47 | 35.12 | 33.85 | 32.63 | 31.48 | 30.39 | 29.35 | 28.37 | 27.45 | 26.57 | 25.75 | 24.97 | 24.24 | 23.56 | 22.92 | 22.32 |
| 48 | 35.45 | 34.12 | 32.86 | 31.67 | 30.54 | 29.46 | 28.44 | 27.48 | 26.56 | 25.70 | 24.89 | 24.13 | 23.41 | 22.74 | 22.11 |
| 49 | 35.78 | 34.41 | 33.10 | 31.86 | 30.69 | 29.57 | 28.51 | 27.51 | 26.56 | 25.66 | 24.81 | 24.01 | 23.26 | 22.56 | 21.90 |
| 50 | 36.12 | 34.70 | 33.34 | 32.06 | 30.84 | 29.68 | 28.58 | 27.54 | 26.55 | 25.62 | 24.74 | 23.90 | 23.12 | 22.38 | 21.69 |
| 51 | 36.46 | 34.99 | 33.59 | 32.26 | 31.00 | 29.79 | 28.65 | 27.57 | 26.55 | 25.58 | 24.66 | 23.79 | 22.97 | 22.20 | 21.47 |
| 52 | 36.80 | 35.28 | 33.83 | 32.46 | 31.15 | 29.90 | 28.72 | 27.60 | 26.54 | 25.53 | 24.58 | 23.67 | 22.82 | 22.02 | 21.26 |
| 53 | 37.14 | 35.57 | 34.07 | 32.65 | 31.30 | 30.01 | 28.79 | 27.63 | 26.52 | 25.48 | 24.49 | 23.55 | 22.66 | 21.83 | 21.04 |
| 54 | 37.47 | 35.85 | 34.30 | 32.83 | 31.44 | 30.11 | 28.84 | 27.64 | 26.50 | 25.42 | 24.39 | 23.42 | 22.50 | 21.63 | 20.81 |
| 55 | 37.79 | 36.12 | 34.53 | 33.01 | 31.57 | 30.19 | 28.89 | 27.65 | 26.47 | 25.35 | 24.28 | 23.27 | 22.32 | 21.42 | 20.56 |
| 56 | 38.11 | 36.38 | 34.73 | 33.17 | 31.68 | 30.26 | 28.92 | 27.63 | 26.42 | 25.26 | 24.16 | 23.12 | 22.13 | 21.19 | 20.31 |
| 57 | 38.40 | 36.62 | 34.92 | 33.31 | 31.78 | 30.32 | 28.93 | 27.60 | 26.35 | 25.15 | 24.02 | 22.94 | 21.92 | 20.95 | 20.03 |
| 58 | 38.67 | 36.84 | 35.09 | 33.43 | 31.85 | 30.34 | 28.91 | 27.55 | 26.25 | 25.02 | 23.85 | 22.74 | 21.68 | 20.68 | 19.73 |
| 59 | 38.91 | 37.03 | 35.23 | 33.52 | 31.89 | 30.34 | 28.87 | 27.46 | 26.13 | 24.86 | 23.65 | 22.51 | 21.42 | 20.38 | 19.40 |
| 60 | 39.12 | 37.18 | 35.33 | 33.57 | 31.90 | 30.31 | 28.79 | 27.35 | 25.97 | 24.67 | 23.42 | 22.24 | 21.12 | 20.06 | 19.05 |
| 61 | 39.29 | 37.29 | 35.39 | 33.59 | 31.87 | 30.23 | 28.67 | 27.19 | 25.78 | 24.43 | 23.16 | 21.94 | 20.79 | 19.69 | 18.65 |
| 62 | 39.40 | 37.35 | 35.40 | 33.55 | 31.78 | 30.10 | 28.50 | 26.98 | 25.53 | 24.15 | 22.84 | 21.60 | 20.41 | 19.28 | 18.21 |
| 63 | 39.46 | 37.36 | 35.36 | 33.45 | 31.64 | 29.92 | 28.28 | 26.72 | 25.24 | 23.82 | 22.48 | 21.20 | 19.98 | 18.82 | 17.72 |
| 64 | 39.45 | 37.29 | 35.24 | 33.29 | 31.44 | 29.67 | 28.00 | 26.40 | 24.88 | 23.43 | 22.05 | 20.74 | 19.49 | 18.30 | 17.18 |
| 65 | 39.35 | 37.15 | 35.05 | 33.05 | 31.16 | 29.35 | 27.63 | 26.00 | 24.44 | 22.96 | 21.55 | 20.21 | 18.94 | 17.72 | 16.57 |

**Table A5.** Minimum daily efficiencies (in percent) for latitudes [0°, 65°]; slope angles [61°, 75°].

|           | 61    | 62    | 63    | 64    | 65    | 66    | 67    | 68    | 69    | 70    | 71    | 72    | 73    | 74    | 75    |
|-----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| <b>0</b>  | 58.43 | 59.86 | 61.36 | 62.95 | 64.61 | 66.36 | 68.20 | 70.14 | 72.17 | 74.31 | 76.55 | 78.91 | 81.38 | 83.99 | 86.73 |
| <b>1</b>  | 56.73 | 58.09 | 59.52 | 61.03 | 62.62 | 64.29 | 66.05 | 67.89 | 69.83 | 71.87 | 74.02 | 76.27 | 78.63 | 81.11 | 83.73 |
| <b>2</b>  | 55.09 | 56.38 | 57.75 | 59.19 | 60.70 | 62.30 | 63.97 | 65.73 | 67.59 | 69.53 | 71.58 | 73.73 | 75.98 | 78.35 | 80.85 |
| <b>3</b>  | 53.51 | 54.74 | 56.04 | 57.41 | 58.85 | 60.37 | 61.97 | 63.65 | 65.42 | 67.28 | 69.23 | 71.28 | 73.44 | 75.70 | 78.08 |
| <b>4</b>  | 51.99 | 53.16 | 54.39 | 55.70 | 57.07 | 58.52 | 60.05 | 61.65 | 63.34 | 65.11 | 66.97 | 68.93 | 70.99 | 73.15 | 75.42 |
| <b>5</b>  | 50.52 | 51.63 | 52.81 | 54.05 | 55.36 | 56.74 | 58.19 | 59.72 | 61.33 | 63.02 | 64.80 | 66.67 | 68.63 | 70.69 | 72.86 |
| <b>6</b>  | 49.11 | 50.17 | 51.28 | 52.46 | 53.71 | 55.02 | 56.41 | 57.86 | 59.40 | 61.01 | 62.71 | 64.49 | 66.36 | 68.33 | 70.40 |
| <b>7</b>  | 47.76 | 48.76 | 49.81 | 50.93 | 52.12 | 53.37 | 54.68 | 56.07 | 57.53 | 59.07 | 60.69 | 62.39 | 64.18 | 66.06 | 68.03 |
| <b>8</b>  | 46.45 | 47.40 | 48.40 | 49.46 | 50.59 | 51.77 | 53.03 | 54.35 | 55.74 | 57.21 | 58.75 | 60.37 | 62.08 | 63.87 | 65.76 |
| <b>9</b>  | 45.20 | 46.09 | 47.04 | 48.04 | 49.11 | 50.24 | 51.43 | 52.69 | 54.01 | 55.41 | 56.88 | 58.43 | 60.06 | 61.77 | 63.56 |
| <b>10</b> | 43.99 | 44.83 | 45.72 | 46.68 | 47.69 | 48.76 | 49.89 | 51.09 | 52.35 | 53.68 | 55.08 | 56.55 | 58.11 | 59.74 | 61.45 |
| <b>11</b> | 42.82 | 43.62 | 44.46 | 45.36 | 46.32 | 47.33 | 48.41 | 49.54 | 50.74 | 52.01 | 53.34 | 54.75 | 56.23 | 57.78 | 59.42 |
| <b>12</b> | 41.70 | 42.45 | 43.25 | 44.10 | 45.00 | 45.96 | 46.98 | 48.06 | 49.20 | 50.40 | 51.67 | 53.01 | 54.42 | 55.90 | 57.46 |
| <b>13</b> | 40.63 | 41.33 | 42.08 | 42.88 | 43.73 | 44.64 | 45.60 | 46.62 | 47.70 | 48.85 | 50.06 | 51.33 | 52.67 | 54.08 | 55.57 |
| <b>14</b> | 39.59 | 40.25 | 40.95 | 41.70 | 42.51 | 43.36 | 44.27 | 45.24 | 46.27 | 47.35 | 48.50 | 49.71 | 50.99 | 52.33 | 53.75 |
| <b>15</b> | 38.60 | 39.21 | 39.87 | 40.57 | 41.33 | 42.13 | 42.99 | 43.91 | 44.88 | 45.91 | 47.00 | 48.15 | 49.37 | 50.65 | 52.00 |
| <b>16</b> | 37.65 | 38.21 | 38.82 | 39.48 | 40.19 | 40.95 | 41.76 | 42.63 | 43.55 | 44.52 | 45.55 | 46.65 | 47.80 | 49.02 | 50.31 |
| <b>17</b> | 36.73 | 37.25 | 37.82 | 38.44 | 39.10 | 39.81 | 40.57 | 41.39 | 42.26 | 43.18 | 44.16 | 45.20 | 46.29 | 47.45 | 48.67 |
| <b>18</b> | 35.85 | 36.33 | 36.86 | 37.43 | 38.05 | 38.71 | 39.43 | 40.20 | 41.02 | 41.89 | 42.81 | 43.80 | 44.84 | 45.94 | 47.10 |
| <b>19</b> | 35.00 | 35.44 | 35.93 | 36.46 | 37.03 | 37.66 | 38.33 | 39.05 | 39.82 | 40.64 | 41.52 | 42.45 | 43.43 | 44.47 | 45.58 |
| <b>20</b> | 34.19 | 34.59 | 35.04 | 35.53 | 36.06 | 36.64 | 37.27 | 37.94 | 38.66 | 39.44 | 40.26 | 41.14 | 42.08 | 43.06 | 44.11 |
| <b>21</b> | 33.42 | 33.78 | 34.18 | 34.63 | 35.12 | 35.66 | 36.24 | 36.87 | 37.55 | 38.28 | 39.06 | 39.88 | 40.77 | 41.70 | 42.70 |
| <b>22</b> | 32.67 | 32.99 | 33.36 | 33.77 | 34.22 | 34.72 | 35.26 | 35.84 | 36.48 | 37.16 | 37.89 | 38.67 | 39.50 | 40.39 | 41.33 |
| <b>23</b> | 31.96 | 32.24 | 32.57 | 32.94 | 33.35 | 33.81 | 34.31 | 34.85 | 35.44 | 36.08 | 36.76 | 37.50 | 38.28 | 39.12 | 40.01 |
| <b>24</b> | 31.27 | 31.52 | 31.81 | 32.14 | 32.52 | 32.93 | 33.39 | 33.90 | 34.44 | 35.04 | 35.68 | 36.37 | 37.11 | 37.89 | 38.73 |
| <b>25</b> | 30.62 | 30.83 | 31.08 | 31.38 | 31.71 | 32.09 | 32.51 | 32.97 | 33.48 | 34.03 | 34.63 | 35.27 | 35.97 | 36.71 | 37.50 |
| <b>26</b> | 29.99 | 30.17 | 30.39 | 30.64 | 30.94 | 31.28 | 31.66 | 32.08 | 32.55 | 33.06 | 33.62 | 34.22 | 34.87 | 35.56 | 36.31 |
| <b>27</b> | 29.40 | 29.54 | 29.72 | 29.94 | 30.20 | 30.50 | 30.84 | 31.23 | 31.66 | 32.13 | 32.64 | 33.20 | 33.81 | 34.46 | 35.16 |
| <b>28</b> | 28.82 | 28.93 | 29.08 | 29.26 | 29.48 | 29.75 | 30.06 | 30.40 | 30.79 | 31.22 | 31.70 | 32.22 | 32.78 | 33.39 | 34.04 |
| <b>29</b> | 28.28 | 28.35 | 28.46 | 28.61 | 28.80 | 29.03 | 29.30 | 29.61 | 29.96 | 30.35 | 30.79 | 31.26 | 31.79 | 32.35 | 32.97 |
| <b>30</b> | 27.76 | 27.79 | 27.87 | 27.98 | 28.14 | 28.33 | 28.57 | 28.84 | 29.15 | 29.51 | 29.91 | 30.34 | 30.83 | 31.35 | 31.92 |
| <b>31</b> | 27.26 | 27.26 | 27.30 | 27.39 | 27.50 | 27.66 | 27.86 | 28.10 | 28.38 | 28.70 | 29.05 | 29.46 | 29.90 | 30.38 | 30.91 |
| <b>32</b> | 26.79 | 26.76 | 26.76 | 26.81 | 26.90 | 27.02 | 27.18 | 27.39 | 27.63 | 27.91 | 28.23 | 28.60 | 29.00 | 29.45 | 29.94 |

**Continued**

|    |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 33 | 26.33 | 26.27 | 26.24 | 26.26 | 26.31 | 26.40 | 26.53 | 26.70 | 26.90 | 27.15 | 27.44 | 27.76 | 28.13 | 28.54 | 28.99 |
| 34 | 25.90 | 25.81 | 25.75 | 25.73 | 25.75 | 25.80 | 25.90 | 26.03 | 26.20 | 26.42 | 26.67 | 26.96 | 27.29 | 27.66 | 28.07 |
| 35 | 25.49 | 25.36 | 25.27 | 25.22 | 25.20 | 25.23 | 25.29 | 25.39 | 25.53 | 25.70 | 25.92 | 26.18 | 26.47 | 26.81 | 27.18 |
| 36 | 25.10 | 24.94 | 24.82 | 24.73 | 24.68 | 24.67 | 24.70 | 24.77 | 24.87 | 25.02 | 25.20 | 25.42 | 25.68 | 25.98 | 26.32 |
| 37 | 24.73 | 24.53 | 24.38 | 24.26 | 24.18 | 24.14 | 24.13 | 24.17 | 24.24 | 24.35 | 24.50 | 24.68 | 24.91 | 25.17 | 25.48 |
| 38 | 24.37 | 24.15 | 23.96 | 23.81 | 23.70 | 23.62 | 23.59 | 23.59 | 23.63 | 23.70 | 23.82 | 23.97 | 24.16 | 24.39 | 24.66 |
| 39 | 24.03 | 23.77 | 23.55 | 23.37 | 23.23 | 23.12 | 23.06 | 23.03 | 23.03 | 23.08 | 23.16 | 23.28 | 23.44 | 23.63 | 23.87 |
| 40 | 23.71 | 23.42 | 23.17 | 22.95 | 22.78 | 22.64 | 22.54 | 22.48 | 22.46 | 22.47 | 22.52 | 22.61 | 22.73 | 22.89 | 23.09 |
| 41 | 23.40 | 23.08 | 22.79 | 22.55 | 22.34 | 22.18 | 22.04 | 21.95 | 21.90 | 21.88 | 21.89 | 21.95 | 22.04 | 22.17 | 22.34 |
| 42 | 23.10 | 22.75 | 22.44 | 22.16 | 21.92 | 21.72 | 21.56 | 21.44 | 21.35 | 21.30 | 21.29 | 21.31 | 21.37 | 21.47 | 21.60 |
| 43 | 22.82 | 22.43 | 22.09 | 21.78 | 21.51 | 21.28 | 21.09 | 20.93 | 20.82 | 20.74 | 20.69 | 20.68 | 20.71 | 20.78 | 20.88 |
| 44 | 22.54 | 22.13 | 21.75 | 21.41 | 21.11 | 20.85 | 20.63 | 20.44 | 20.30 | 20.18 | 20.11 | 20.07 | 20.07 | 20.11 | 20.18 |
| 45 | 22.28 | 21.83 | 21.42 | 21.06 | 20.73 | 20.43 | 20.18 | 19.97 | 19.79 | 19.64 | 19.54 | 19.47 | 19.44 | 19.44 | 19.48 |
| 46 | 22.02 | 21.54 | 21.10 | 20.70 | 20.34 | 20.02 | 19.74 | 19.49 | 19.29 | 19.11 | 18.98 | 18.88 | 18.82 | 18.79 | 18.80 |
| 47 | 21.77 | 21.26 | 20.79 | 20.36 | 19.97 | 19.62 | 19.31 | 19.03 | 18.79 | 18.59 | 18.43 | 18.30 | 18.21 | 18.15 | 18.13 |
| 48 | 21.53 | 20.98 | 20.48 | 20.02 | 19.60 | 19.22 | 18.88 | 18.57 | 18.31 | 18.08 | 17.88 | 17.73 | 17.60 | 17.52 | 17.47 |
| 49 | 21.28 | 20.71 | 20.18 | 19.69 | 19.24 | 18.83 | 18.45 | 18.12 | 17.82 | 17.56 | 17.34 | 17.16 | 17.01 | 16.89 | 16.81 |
| 50 | 21.04 | 20.43 | 19.87 | 19.35 | 18.87 | 18.43 | 18.03 | 17.67 | 17.34 | 17.05 | 16.80 | 16.59 | 16.41 | 16.27 | 16.16 |
| 51 | 20.80 | 20.16 | 19.57 | 19.02 | 18.51 | 18.04 | 17.61 | 17.22 | 16.86 | 16.55 | 16.27 | 16.02 | 15.82 | 15.65 | 15.51 |
| 52 | 20.55 | 19.88 | 19.26 | 18.68 | 18.14 | 17.64 | 17.18 | 16.76 | 16.38 | 16.04 | 15.73 | 15.46 | 15.22 | 15.03 | 14.86 |
| 53 | 20.29 | 19.60 | 18.94 | 18.33 | 17.76 | 17.24 | 16.75 | 16.30 | 15.89 | 15.52 | 15.19 | 14.89 | 14.63 | 14.40 | 14.21 |
| 54 | 20.03 | 19.30 | 18.62 | 17.98 | 17.38 | 16.83 | 16.31 | 15.83 | 15.40 | 15.00 | 14.64 | 14.31 | 14.03 | 13.77 | 13.56 |
| 55 | 19.76 | 19.00 | 18.29 | 17.62 | 16.99 | 16.41 | 15.86 | 15.36 | 14.89 | 14.47 | 14.08 | 13.73 | 13.42 | 13.14 | 12.89 |
| 56 | 19.47 | 18.68 | 17.94 | 17.24 | 16.58 | 15.97 | 15.40 | 14.87 | 14.38 | 13.93 | 13.51 | 13.13 | 12.79 | 12.49 | 12.22 |
| 57 | 19.16 | 18.34 | 17.57 | 16.84 | 16.16 | 15.52 | 14.92 | 14.36 | 13.85 | 13.37 | 12.93 | 12.52 | 12.16 | 11.83 | 11.53 |
| 58 | 18.83 | 17.98 | 17.18 | 16.42 | 15.71 | 15.05 | 14.42 | 13.84 | 13.29 | 12.79 | 12.32 | 11.90 | 11.51 | 11.15 | 10.83 |
| 59 | 18.47 | 17.60 | 16.77 | 15.98 | 15.24 | 14.55 | 13.90 | 13.29 | 12.72 | 12.19 | 11.70 | 11.25 | 10.83 | 10.45 | 10.11 |
| 60 | 18.09 | 17.18 | 16.32 | 15.51 | 14.74 | 14.02 | 13.35 | 12.71 | 12.12 | 11.56 | 11.05 | 10.57 | 10.13 | 9.73  | 9.36  |
| 61 | 17.66 | 16.73 | 15.84 | 15.00 | 14.21 | 13.46 | 12.76 | 12.10 | 11.48 | 10.90 | 10.37 | 9.86  | 9.40  | 8.98  | 8.59  |
| 62 | 17.19 | 16.23 | 15.32 | 14.45 | 13.64 | 12.86 | 12.14 | 11.45 | 10.81 | 10.21 | 9.65  | 9.12  | 8.64  | 8.19  | 7.78  |
| 63 | 16.68 | 15.69 | 14.75 | 13.86 | 13.02 | 12.22 | 11.47 | 10.76 | 10.10 | 9.47  | 8.89  | 8.34  | 7.84  | 7.37  | 6.93  |
| 64 | 16.11 | 15.09 | 14.12 | 13.21 | 12.34 | 11.52 | 10.75 | 10.02 | 9.33  | 8.69  | 8.08  | 7.51  | 6.99  | 6.50  | 6.04  |
| 65 | 15.47 | 14.43 | 13.44 | 12.50 | 11.61 | 10.77 | 9.97  | 9.22  | 8.51  | 7.85  | 7.22  | 6.63  | 6.09  | 5.58  | 5.10  |

**Table A6.** Minimum daily efficiencies (in percent) for latitudes [0°, 65°]; slope angles [76°, 90°].

|    | 76    | 77    | 78    | 79    | 80     | 81     | 82     | 83     | 84     | 85     | 86     | 87     | 88     | 89     | 90     |
|----|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 0  | 89.60 | 92.63 | 95.82 | 99.17 | 102.71 | 106.44 | 110.37 | 114.52 | 118.91 | 123.55 | 128.46 | 133.66 | 139.19 | 145.05 | 151.29 |
| 1  | 86.47 | 89.36 | 92.40 | 95.59 | 98.96  | 102.51 | 106.25 | 110.20 | 114.36 | 118.77 | 123.42 | 128.36 | 133.58 | 139.13 | 145.02 |
| 2  | 83.47 | 86.22 | 89.12 | 92.16 | 95.37  | 98.75  | 102.31 | 106.06 | 110.02 | 114.21 | 118.63 | 123.30 | 128.25 | 133.50 | 139.07 |
| 3  | 80.58 | 83.21 | 85.97 | 88.87 | 91.93  | 95.15  | 98.54  | 102.11 | 105.88 | 109.85 | 114.05 | 118.49 | 123.18 | 128.15 | 133.42 |
| 4  | 77.80 | 80.31 | 82.95 | 85.72 | 88.63  | 91.70  | 94.93  | 98.33  | 101.91 | 105.69 | 109.68 | 113.89 | 118.35 | 123.06 | 128.05 |
| 5  | 75.14 | 77.53 | 80.05 | 82.69 | 85.47  | 88.39  | 91.47  | 94.71  | 98.12  | 101.71 | 105.51 | 109.51 | 113.74 | 118.21 | 122.94 |
| 6  | 72.57 | 74.86 | 77.26 | 79.78 | 82.43  | 85.22  | 88.15  | 91.24  | 94.48  | 97.91  | 101.51 | 105.32 | 109.34 | 113.58 | 118.07 |
| 7  | 70.11 | 72.29 | 74.58 | 76.99 | 79.51  | 82.17  | 84.97  | 87.91  | 91.00  | 94.26  | 97.70  | 101.32 | 105.14 | 109.17 | 113.42 |
| 8  | 67.74 | 69.82 | 72.00 | 74.30 | 76.71  | 79.25  | 81.92  | 84.72  | 87.67  | 90.77  | 94.04  | 97.49  | 101.12 | 104.95 | 108.99 |
| 9  | 65.45 | 67.44 | 69.53 | 71.72 | 74.02  | 76.44  | 78.98  | 81.66  | 84.47  | 87.43  | 90.54  | 93.82  | 97.28  | 100.92 | 104.76 |
| 10 | 63.26 | 65.15 | 67.14 | 69.23 | 71.43  | 73.74  | 76.17  | 78.72  | 81.40  | 84.22  | 87.19  | 90.31  | 93.60  | 97.07  | 100.72 |
| 11 | 61.14 | 62.95 | 64.85 | 66.85 | 68.94  | 71.15  | 73.46  | 75.90  | 78.45  | 81.14  | 83.97  | 86.95  | 90.08  | 93.38  | 96.86  |
| 12 | 59.10 | 60.83 | 62.64 | 64.55 | 66.55  | 68.65  | 70.86  | 73.18  | 75.62  | 78.19  | 80.88  | 83.72  | 86.71  | 89.85  | 93.16  |
| 13 | 57.14 | 58.78 | 60.51 | 62.33 | 64.24  | 66.25  | 68.36  | 70.57  | 72.90  | 75.35  | 77.92  | 80.63  | 83.47  | 86.46  | 89.62  |
| 14 | 55.24 | 56.81 | 58.46 | 60.20 | 62.02  | 63.94  | 65.95  | 68.07  | 70.29  | 72.62  | 75.08  | 77.65  | 80.37  | 83.22  | 86.22  |
| 15 | 53.42 | 54.92 | 56.49 | 58.14 | 59.88  | 61.71  | 63.63  | 65.65  | 67.77  | 70.00  | 72.34  | 74.80  | 77.39  | 80.11  | 82.97  |
| 16 | 51.66 | 53.09 | 54.59 | 56.16 | 57.82  | 59.57  | 61.40  | 63.33  | 65.35  | 67.48  | 69.71  | 72.06  | 74.52  | 77.12  | 79.84  |
| 17 | 49.96 | 51.32 | 52.75 | 54.26 | 55.84  | 57.50  | 59.25  | 61.09  | 63.02  | 65.05  | 67.18  | 69.42  | 71.77  | 74.25  | 76.85  |
| 18 | 48.33 | 49.62 | 50.98 | 52.41 | 53.92  | 55.51  | 57.18  | 58.93  | 60.77  | 62.71  | 64.74  | 66.88  | 69.13  | 71.49  | 73.97  |
| 19 | 46.74 | 47.98 | 49.27 | 50.64 | 52.08  | 53.59  | 55.18  | 56.85  | 58.61  | 60.46  | 62.40  | 64.44  | 66.58  | 68.83  | 71.20  |
| 20 | 45.22 | 46.39 | 47.62 | 48.92 | 50.29  | 51.74  | 53.25  | 54.85  | 56.53  | 58.29  | 60.14  | 62.09  | 64.13  | 66.28  | 68.54  |
| 21 | 43.75 | 44.86 | 46.03 | 47.27 | 48.57  | 49.95  | 51.39  | 52.92  | 54.52  | 56.20  | 57.97  | 59.82  | 61.77  | 63.82  | 65.98  |
| 22 | 42.33 | 43.38 | 44.50 | 45.67 | 46.91  | 48.22  | 49.60  | 51.05  | 52.58  | 54.18  | 55.87  | 57.64  | 59.50  | 61.46  | 63.51  |
| 23 | 40.95 | 41.95 | 43.01 | 44.13 | 45.31  | 46.56  | 47.87  | 49.25  | 50.70  | 52.23  | 53.84  | 55.53  | 57.31  | 59.18  | 61.14  |
| 24 | 39.63 | 40.57 | 41.58 | 42.64 | 43.76  | 44.95  | 46.19  | 47.51  | 48.90  | 50.35  | 51.89  | 53.50  | 55.20  | 56.98  | 58.85  |
| 25 | 38.34 | 39.24 | 40.19 | 41.20 | 42.26  | 43.39  | 44.58  | 45.83  | 47.15  | 48.54  | 50.00  | 51.54  | 53.16  | 54.86  | 56.64  |
| 26 | 37.10 | 37.95 | 38.85 | 39.80 | 40.82  | 41.88  | 43.01  | 44.21  | 45.46  | 46.79  | 48.18  | 49.65  | 51.19  | 52.81  | 54.51  |
| 27 | 35.91 | 36.70 | 37.55 | 38.46 | 39.42  | 40.43  | 41.50  | 42.64  | 43.83  | 45.09  | 46.42  | 47.82  | 49.29  | 50.83  | 52.46  |
| 28 | 34.75 | 35.50 | 36.30 | 37.15 | 38.06  | 39.02  | 40.04  | 41.12  | 42.25  | 43.45  | 44.72  | 46.05  | 47.45  | 48.92  | 50.47  |
| 29 | 33.62 | 34.33 | 35.09 | 35.89 | 36.75  | 37.66  | 38.63  | 39.65  | 40.73  | 41.87  | 43.07  | 44.34  | 45.67  | 47.08  | 48.56  |
| 30 | 32.54 | 33.20 | 33.91 | 34.67 | 35.48  | 36.34  | 37.25  | 38.22  | 39.25  | 40.33  | 41.48  | 42.68  | 43.95  | 45.29  | 46.70  |
| 31 | 31.49 | 32.11 | 32.77 | 33.49 | 34.25  | 35.06  | 35.93  | 36.84  | 37.82  | 38.85  | 39.93  | 41.08  | 42.29  | 43.56  | 44.91  |
| 32 | 30.47 | 31.05 | 31.67 | 32.34 | 33.06  | 33.82  | 34.64  | 35.51  | 36.43  | 37.40  | 38.44  | 39.53  | 40.68  | 41.89  | 43.17  |

## Continued

|    |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 33 | 29.48 | 30.02 | 30.60 | 31.23 | 31.90 | 32.62 | 33.39 | 34.21 | 35.08 | 36.01 | 36.99 | 38.02 | 39.12 | 40.27 | 41.49 |
| 34 | 28.53 | 29.02 | 29.56 | 30.15 | 30.78 | 31.46 | 32.18 | 32.95 | 33.78 | 34.65 | 35.58 | 36.56 | 37.60 | 38.70 | 39.86 |
| 35 | 27.60 | 28.06 | 28.56 | 29.10 | 29.69 | 30.33 | 31.01 | 31.73 | 32.51 | 33.34 | 34.22 | 35.15 | 36.13 | 37.18 | 38.28 |
| 36 | 26.70 | 27.12 | 27.58 | 28.08 | 28.63 | 29.23 | 29.86 | 30.55 | 31.28 | 32.06 | 32.89 | 33.77 | 34.71 | 35.70 | 36.74 |
| 37 | 25.82 | 26.20 | 26.63 | 27.10 | 27.60 | 28.16 | 28.75 | 29.39 | 30.08 | 30.82 | 31.60 | 32.44 | 33.32 | 34.26 | 35.25 |
| 38 | 24.97 | 25.32 | 25.70 | 26.13 | 26.60 | 27.12 | 27.67 | 28.27 | 28.92 | 29.61 | 30.35 | 31.14 | 31.97 | 32.86 | 33.81 |
| 39 | 24.14 | 24.45 | 24.80 | 25.20 | 25.63 | 26.10 | 26.62 | 27.18 | 27.78 | 28.43 | 29.13 | 29.87 | 30.66 | 31.50 | 32.40 |
| 40 | 23.33 | 23.61 | 23.93 | 24.28 | 24.68 | 25.12 | 25.59 | 26.11 | 26.68 | 27.29 | 27.94 | 28.64 | 29.38 | 30.18 | 31.02 |
| 41 | 22.54 | 22.79 | 23.07 | 23.39 | 23.75 | 24.15 | 24.59 | 25.08 | 25.60 | 26.17 | 26.78 | 27.44 | 28.14 | 28.89 | 29.69 |
| 42 | 21.78 | 21.99 | 22.23 | 22.52 | 22.85 | 23.21 | 23.61 | 24.06 | 24.55 | 25.08 | 25.65 | 26.26 | 26.92 | 27.63 | 28.38 |
| 43 | 21.02 | 21.20 | 21.42 | 21.67 | 21.96 | 22.29 | 22.66 | 23.07 | 23.52 | 24.01 | 24.54 | 25.12 | 25.74 | 26.40 | 27.11 |
| 44 | 20.29 | 20.43 | 20.61 | 20.83 | 21.09 | 21.39 | 21.72 | 22.09 | 22.51 | 22.96 | 23.46 | 23.99 | 24.57 | 25.20 | 25.86 |
| 45 | 19.56 | 19.68 | 19.83 | 20.01 | 20.24 | 20.50 | 20.80 | 21.14 | 21.52 | 21.94 | 22.39 | 22.89 | 23.43 | 24.02 | 24.65 |
| 46 | 18.85 | 18.93 | 19.05 | 19.21 | 19.40 | 19.63 | 19.90 | 20.20 | 20.55 | 20.93 | 21.35 | 21.81 | 22.32 | 22.86 | 23.45 |
| 47 | 18.15 | 18.20 | 18.29 | 18.42 | 18.58 | 18.78 | 19.01 | 19.28 | 19.59 | 19.94 | 20.33 | 20.75 | 21.22 | 21.73 | 22.28 |
| 48 | 17.46 | 17.48 | 17.54 | 17.63 | 17.76 | 17.93 | 18.13 | 18.37 | 18.65 | 18.97 | 19.32 | 19.71 | 20.14 | 20.61 | 21.12 |
| 49 | 16.77 | 16.77 | 16.79 | 16.86 | 16.96 | 17.10 | 17.27 | 17.48 | 17.72 | 18.00 | 18.32 | 18.68 | 19.08 | 19.51 | 19.99 |
| 50 | 16.09 | 16.06 | 16.06 | 16.09 | 16.16 | 16.27 | 16.41 | 16.59 | 16.80 | 17.05 | 17.34 | 17.66 | 18.03 | 18.43 | 18.87 |
| 51 | 15.41 | 15.35 | 15.32 | 15.33 | 15.37 | 15.45 | 15.56 | 15.71 | 15.89 | 16.11 | 16.36 | 16.66 | 16.99 | 17.35 | 17.76 |
| 52 | 14.74 | 14.65 | 14.59 | 14.57 | 14.58 | 14.63 | 14.71 | 14.83 | 14.98 | 15.17 | 15.40 | 15.66 | 15.96 | 16.29 | 16.66 |
| 53 | 14.06 | 13.94 | 13.86 | 13.81 | 13.79 | 13.81 | 13.87 | 13.96 | 14.08 | 14.24 | 14.43 | 14.66 | 14.93 | 15.23 | 15.57 |
| 54 | 13.38 | 13.23 | 13.12 | 13.04 | 13.00 | 12.99 | 13.02 | 13.08 | 13.18 | 13.31 | 13.47 | 13.67 | 13.91 | 14.18 | 14.49 |
| 55 | 12.69 | 12.51 | 12.38 | 12.27 | 12.21 | 12.17 | 12.17 | 12.20 | 12.27 | 12.37 | 12.51 | 12.68 | 12.89 | 13.13 | 13.41 |
| 56 | 11.99 | 11.79 | 11.63 | 11.50 | 11.40 | 11.34 | 11.31 | 11.32 | 11.36 | 11.44 | 11.55 | 11.69 | 11.87 | 12.08 | 12.33 |
| 57 | 11.28 | 11.05 | 10.86 | 10.71 | 10.59 | 10.50 | 10.45 | 10.43 | 10.45 | 10.49 | 10.58 | 10.69 | 10.84 | 11.02 | 11.24 |
| 58 | 10.55 | 10.30 | 10.09 | 9.91  | 9.76  | 9.65  | 9.57  | 9.53  | 9.52  | 9.54  | 9.59  | 9.68  | 9.81  | 9.96  | 10.15 |
| 59 | 9.80  | 9.53  | 9.29  | 9.09  | 8.92  | 8.78  | 8.68  | 8.61  | 8.57  | 8.57  | 8.60  | 8.66  | 8.76  | 8.89  | 9.05  |
| 60 | 9.03  | 8.74  | 8.47  | 8.25  | 8.05  | 7.89  | 7.77  | 7.67  | 7.61  | 7.59  | 7.59  | 7.63  | 7.70  | 7.80  | 7.94  |
| 61 | 8.23  | 7.91  | 7.63  | 7.38  | 7.16  | 6.98  | 6.83  | 6.71  | 6.63  | 6.58  | 6.56  | 6.57  | 6.62  | 6.70  | 6.81  |
| 62 | 7.40  | 7.06  | 6.76  | 6.48  | 6.25  | 6.04  | 5.87  | 5.73  | 5.62  | 5.55  | 5.50  | 5.49  | 5.52  | 5.57  | 5.66  |
| 63 | 6.54  | 6.17  | 5.85  | 5.55  | 5.29  | 5.06  | 4.87  | 4.71  | 4.58  | 4.48  | 4.42  | 4.39  | 4.38  | 4.41  | 4.48  |
| 64 | 5.62  | 5.24  | 4.89  | 4.58  | 4.30  | 4.05  | 3.84  | 3.65  | 3.50  | 3.38  | 3.30  | 3.24  | 3.22  | 3.23  | 3.27  |
| 65 | 4.66  | 4.26  | 3.89  | 3.56  | 3.26  | 2.99  | 2.76  | 2.55  | 2.38  | 2.25  | 2.14  | 2.06  | 2.02  | 2.00  | 2.02  |

**Table A7.** Maximum daily efficiencies for latitudes [0°, 65°]; slope angles [0°, 15°].

|    | 0    | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   | 13   | 14   | 15   |
|----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 0  | 0.71 | 0.73 | 0.76 | 0.78 | 0.80 | 0.83 | 0.85 | 0.88 | 0.91 | 0.94 | 0.98 | 1.01 | 1.05 | 1.09 | 1.13 | 1.17 |
| 1  | 0.72 | 0.72 | 0.74 | 0.76 | 0.79 | 0.81 | 0.84 | 0.86 | 0.89 | 0.92 | 0.95 | 0.99 | 1.02 | 1.06 | 1.10 | 1.14 |
| 2  | 0.74 | 0.72 | 0.73 | 0.75 | 0.77 | 0.80 | 0.82 | 0.85 | 0.87 | 0.90 | 0.93 | 0.96 | 1.00 | 1.03 | 1.07 | 1.11 |
| 3  | 0.75 | 0.73 | 0.72 | 0.74 | 0.76 | 0.78 | 0.81 | 0.83 | 0.86 | 0.88 | 0.91 | 0.94 | 0.98 | 1.01 | 1.04 | 1.08 |
| 4  | 0.77 | 0.74 | 0.72 | 0.73 | 0.75 | 0.77 | 0.79 | 0.81 | 0.84 | 0.87 | 0.89 | 0.92 | 0.95 | 0.99 | 1.02 | 1.06 |
| 5  | 0.78 | 0.76 | 0.73 | 0.71 | 0.73 | 0.75 | 0.78 | 0.80 | 0.82 | 0.85 | 0.88 | 0.90 | 0.93 | 0.96 | 1.00 | 1.03 |
| 6  | 0.80 | 0.77 | 0.75 | 0.73 | 0.72 | 0.74 | 0.76 | 0.79 | 0.81 | 0.83 | 0.86 | 0.89 | 0.91 | 0.94 | 0.98 | 1.01 |
| 7  | 0.82 | 0.79 | 0.76 | 0.74 | 0.72 | 0.73 | 0.75 | 0.77 | 0.80 | 0.82 | 0.84 | 0.87 | 0.90 | 0.93 | 0.96 | 0.99 |
| 8  | 0.83 | 0.81 | 0.78 | 0.76 | 0.73 | 0.72 | 0.74 | 0.76 | 0.78 | 0.80 | 0.83 | 0.85 | 0.88 | 0.91 | 0.94 | 0.97 |
| 9  | 0.85 | 0.82 | 0.80 | 0.77 | 0.75 | 0.72 | 0.73 | 0.75 | 0.77 | 0.79 | 0.81 | 0.84 | 0.86 | 0.89 | 0.92 | 0.95 |
| 10 | 0.87 | 0.84 | 0.82 | 0.79 | 0.76 | 0.74 | 0.72 | 0.74 | 0.76 | 0.78 | 0.80 | 0.82 | 0.85 | 0.87 | 0.90 | 0.93 |
| 11 | 0.89 | 0.86 | 0.83 | 0.81 | 0.78 | 0.75 | 0.73 | 0.73 | 0.75 | 0.77 | 0.79 | 0.81 | 0.83 | 0.86 | 0.88 | 0.91 |
| 12 | 0.92 | 0.88 | 0.85 | 0.82 | 0.80 | 0.77 | 0.75 | 0.72 | 0.74 | 0.76 | 0.78 | 0.80 | 0.82 | 0.84 | 0.87 | 0.90 |
| 13 | 0.94 | 0.91 | 0.87 | 0.84 | 0.82 | 0.79 | 0.76 | 0.74 | 0.73 | 0.75 | 0.77 | 0.79 | 0.81 | 0.83 | 0.85 | 0.88 |
| 14 | 0.97 | 0.93 | 0.90 | 0.86 | 0.83 | 0.81 | 0.78 | 0.75 | 0.73 | 0.74 | 0.76 | 0.78 | 0.80 | 0.82 | 0.84 | 0.87 |
| 15 | 0.99 | 0.95 | 0.92 | 0.89 | 0.85 | 0.83 | 0.80 | 0.77 | 0.74 | 0.73 | 0.75 | 0.77 | 0.79 | 0.81 | 0.83 | 0.85 |
| 16 | 1.02 | 0.98 | 0.94 | 0.91 | 0.88 | 0.85 | 0.82 | 0.79 | 0.76 | 0.74 | 0.74 | 0.76 | 0.78 | 0.80 | 0.82 | 0.84 |
| 17 | 1.05 | 1.01 | 0.97 | 0.93 | 0.90 | 0.87 | 0.84 | 0.81 | 0.78 | 0.75 | 0.73 | 0.75 | 0.77 | 0.79 | 0.81 | 0.83 |
| 18 | 1.08 | 1.04 | 1.00 | 0.96 | 0.92 | 0.89 | 0.86 | 0.83 | 0.80 | 0.77 | 0.74 | 0.74 | 0.76 | 0.78 | 0.80 | 0.82 |
| 19 | 1.11 | 1.07 | 1.02 | 0.98 | 0.95 | 0.91 | 0.88 | 0.85 | 0.82 | 0.79 | 0.76 | 0.73 | 0.75 | 0.77 | 0.79 | 0.81 |
| 20 | 1.14 | 1.10 | 1.05 | 1.01 | 0.97 | 0.94 | 0.90 | 0.87 | 0.84 | 0.81 | 0.78 | 0.75 | 0.74 | 0.76 | 0.78 | 0.80 |
| 21 | 1.18 | 1.13 | 1.08 | 1.04 | 1.00 | 0.96 | 0.92 | 0.89 | 0.86 | 0.83 | 0.80 | 0.77 | 0.74 | 0.75 | 0.77 | 0.79 |
| 22 | 1.22 | 1.16 | 1.12 | 1.07 | 1.03 | 0.99 | 0.95 | 0.91 | 0.88 | 0.85 | 0.82 | 0.79 | 0.76 | 0.75 | 0.76 | 0.78 |
| 23 | 1.25 | 1.20 | 1.15 | 1.10 | 1.06 | 1.02 | 0.98 | 0.94 | 0.90 | 0.87 | 0.84 | 0.81 | 0.78 | 0.75 | 0.76 | 0.77 |
| 24 | 1.30 | 1.24 | 1.19 | 1.14 | 1.09 | 1.05 | 1.00 | 0.96 | 0.93 | 0.89 | 0.86 | 0.83 | 0.80 | 0.77 | 0.75 | 0.77 |
| 25 | 1.34 | 1.28 | 1.22 | 1.17 | 1.12 | 1.08 | 1.03 | 0.99 | 0.95 | 0.92 | 0.88 | 0.85 | 0.82 | 0.79 | 0.76 | 0.76 |
| 26 | 1.39 | 1.32 | 1.27 | 1.21 | 1.16 | 1.11 | 1.06 | 1.02 | 0.98 | 0.94 | 0.90 | 0.87 | 0.84 | 0.81 | 0.78 | 0.76 |
| 27 | 1.43 | 1.37 | 1.31 | 1.25 | 1.20 | 1.14 | 1.10 | 1.05 | 1.01 | 0.97 | 0.93 | 0.89 | 0.86 | 0.83 | 0.79 | 0.77 |
| 28 | 1.49 | 1.42 | 1.35 | 1.29 | 1.23 | 1.18 | 1.13 | 1.08 | 1.04 | 1.00 | 0.95 | 0.92 | 0.88 | 0.85 | 0.81 | 0.78 |
| 29 | 1.54 | 1.47 | 1.40 | 1.34 | 1.27 | 1.22 | 1.17 | 1.12 | 1.07 | 1.02 | 0.98 | 0.94 | 0.91 | 0.87 | 0.84 | 0.80 |
| 30 | 1.60 | 1.52 | 1.45 | 1.38 | 1.32 | 1.26 | 1.20 | 1.15 | 1.10 | 1.05 | 1.01 | 0.97 | 0.93 | 0.89 | 0.86 | 0.82 |
| 31 | 1.66 | 1.58 | 1.50 | 1.43 | 1.36 | 1.30 | 1.24 | 1.19 | 1.14 | 1.09 | 1.04 | 1.00 | 0.96 | 0.92 | 0.88 | 0.85 |
| 32 | 1.73 | 1.64 | 1.56 | 1.48 | 1.41 | 1.35 | 1.28 | 1.23 | 1.17 | 1.12 | 1.07 | 1.03 | 0.98 | 0.94 | 0.91 | 0.87 |



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|    |       |       |       |       |       |      |      |      |      |      |      |      |      |      |      |      |
|----|-------|-------|-------|-------|-------|------|------|------|------|------|------|------|------|------|------|------|
| 33 | 1.80  | 1.70  | 1.62  | 1.54  | 1.46  | 1.39 | 1.33 | 1.27 | 1.21 | 1.16 | 1.11 | 1.06 | 1.01 | 0.97 | 0.93 | 0.89 |
| 34 | 1.87  | 1.77  | 1.68  | 1.60  | 1.52  | 1.44 | 1.37 | 1.31 | 1.25 | 1.19 | 1.14 | 1.09 | 1.04 | 1.00 | 0.96 | 0.92 |
| 35 | 1.95  | 1.84  | 1.75  | 1.66  | 1.57  | 1.50 | 1.42 | 1.36 | 1.29 | 1.23 | 1.18 | 1.12 | 1.07 | 1.03 | 0.98 | 0.94 |
| 36 | 2.03  | 1.92  | 1.82  | 1.72  | 1.63  | 1.55 | 1.47 | 1.40 | 1.34 | 1.27 | 1.21 | 1.16 | 1.11 | 1.06 | 1.01 | 0.97 |
| 37 | 2.13  | 2.01  | 1.89  | 1.79  | 1.70  | 1.61 | 1.53 | 1.45 | 1.38 | 1.32 | 1.26 | 1.20 | 1.14 | 1.09 | 1.04 | 1.00 |
| 38 | 2.22  | 2.09  | 1.98  | 1.87  | 1.77  | 1.67 | 1.59 | 1.51 | 1.43 | 1.36 | 1.30 | 1.24 | 1.18 | 1.13 | 1.08 | 1.03 |
| 39 | 2.33  | 2.19  | 2.06  | 1.95  | 1.84  | 1.74 | 1.65 | 1.56 | 1.48 | 1.41 | 1.34 | 1.28 | 1.22 | 1.16 | 1.11 | 1.06 |
| 40 | 2.44  | 2.29  | 2.16  | 2.03  | 1.92  | 1.81 | 1.71 | 1.62 | 1.54 | 1.46 | 1.39 | 1.32 | 1.26 | 1.20 | 1.14 | 1.09 |
| 41 | 2.57  | 2.40  | 2.26  | 2.12  | 2.00  | 1.89 | 1.78 | 1.69 | 1.60 | 1.51 | 1.44 | 1.37 | 1.30 | 1.24 | 1.18 | 1.13 |
| 42 | 2.70  | 2.52  | 2.36  | 2.22  | 2.09  | 1.97 | 1.85 | 1.75 | 1.66 | 1.57 | 1.49 | 1.42 | 1.35 | 1.28 | 1.22 | 1.16 |
| 43 | 2.84  | 2.65  | 2.48  | 2.32  | 2.18  | 2.05 | 1.93 | 1.82 | 1.72 | 1.63 | 1.55 | 1.47 | 1.39 | 1.32 | 1.26 | 1.20 |
| 44 | 3.00  | 2.79  | 2.60  | 2.44  | 2.28  | 2.14 | 2.02 | 1.90 | 1.79 | 1.69 | 1.60 | 1.52 | 1.44 | 1.37 | 1.30 | 1.24 |
| 45 | 3.18  | 2.95  | 2.74  | 2.56  | 2.39  | 2.24 | 2.11 | 1.98 | 1.87 | 1.76 | 1.67 | 1.58 | 1.49 | 1.42 | 1.34 | 1.28 |
| 46 | 3.37  | 3.11  | 2.89  | 2.69  | 2.51  | 2.35 | 2.20 | 2.07 | 1.95 | 1.83 | 1.73 | 1.64 | 1.55 | 1.47 | 1.39 | 1.32 |
| 47 | 3.58  | 3.30  | 3.05  | 2.83  | 2.64  | 2.46 | 2.30 | 2.16 | 2.03 | 1.91 | 1.80 | 1.70 | 1.61 | 1.52 | 1.44 | 1.37 |
| 48 | 3.81  | 3.50  | 3.23  | 2.99  | 2.77  | 2.58 | 2.41 | 2.26 | 2.12 | 1.99 | 1.87 | 1.77 | 1.67 | 1.58 | 1.49 | 1.41 |
| 49 | 4.07  | 3.72  | 3.42  | 3.16  | 2.92  | 2.72 | 2.53 | 2.36 | 2.21 | 2.08 | 1.95 | 1.84 | 1.73 | 1.63 | 1.54 | 1.46 |
| 50 | 4.36  | 3.97  | 3.64  | 3.34  | 3.09  | 2.86 | 2.66 | 2.48 | 2.31 | 2.17 | 2.03 | 1.91 | 1.80 | 1.70 | 1.60 | 1.51 |
| 51 | 4.69  | 4.25  | 3.88  | 3.55  | 3.27  | 3.02 | 2.80 | 2.60 | 2.42 | 2.27 | 2.12 | 1.99 | 1.87 | 1.76 | 1.66 | 1.57 |
| 52 | 5.07  | 4.57  | 4.14  | 3.78  | 3.46  | 3.19 | 2.95 | 2.73 | 2.54 | 2.37 | 2.22 | 2.07 | 1.95 | 1.83 | 1.72 | 1.63 |
| 53 | 5.50  | 4.92  | 4.44  | 4.03  | 3.68  | 3.38 | 3.11 | 2.88 | 2.67 | 2.48 | 2.32 | 2.16 | 2.03 | 1.90 | 1.79 | 1.69 |
| 54 | 6.01  | 5.33  | 4.78  | 4.31  | 3.92  | 3.58 | 3.29 | 3.03 | 2.80 | 2.60 | 2.42 | 2.26 | 2.11 | 1.98 | 1.86 | 1.75 |
| 55 | 6.60  | 5.80  | 5.16  | 4.63  | 4.19  | 3.81 | 3.48 | 3.20 | 2.95 | 2.73 | 2.54 | 2.36 | 2.20 | 2.06 | 1.93 | 1.81 |
| 56 | 7.30  | 6.35  | 5.60  | 4.99  | 4.49  | 4.06 | 3.70 | 3.38 | 3.11 | 2.87 | 2.66 | 2.47 | 2.30 | 2.15 | 2.01 | 1.88 |
| 57 | 8.15  | 7.00  | 6.11  | 5.40  | 4.82  | 4.34 | 3.93 | 3.59 | 3.29 | 3.02 | 2.79 | 2.59 | 2.40 | 2.24 | 2.09 | 1.96 |
| 58 | 9.20  | 7.78  | 6.71  | 5.88  | 5.21  | 4.66 | 4.20 | 3.81 | 3.48 | 3.19 | 2.93 | 2.71 | 2.51 | 2.34 | 2.18 | 2.03 |
| 59 | 10.53 | 8.74  | 7.43  | 6.43  | 5.65  | 5.01 | 4.49 | 4.05 | 3.68 | 3.36 | 3.09 | 2.84 | 2.63 | 2.44 | 2.27 | 2.11 |
| 60 | 12.27 | 9.92  | 8.29  | 7.08  | 6.15  | 5.42 | 4.82 | 4.33 | 3.91 | 3.56 | 3.25 | 2.99 | 2.75 | 2.55 | 2.36 | 2.20 |
| 61 | 14.63 | 11.45 | 9.35  | 7.86  | 6.74  | 5.88 | 5.19 | 4.63 | 4.16 | 3.77 | 3.43 | 3.14 | 2.89 | 2.66 | 2.47 | 2.29 |
| 62 | 18.03 | 13.48 | 10.69 | 8.80  | 7.44  | 6.42 | 5.61 | 4.97 | 4.44 | 4.00 | 3.63 | 3.31 | 3.03 | 2.79 | 2.57 | 2.38 |
| 63 | 23.35 | 16.31 | 12.43 | 9.98  | 8.28  | 7.04 | 6.10 | 5.35 | 4.75 | 4.25 | 3.84 | 3.49 | 3.18 | 2.92 | 2.68 | 2.48 |
| 64 | 32.84 | 20.53 | 14.79 | 11.47 | 9.31  | 7.78 | 6.66 | 5.79 | 5.10 | 4.53 | 4.07 | 3.68 | 3.34 | 3.05 | 2.80 | 2.58 |
| 65 | 54.58 | 27.49 | 18.16 | 13.44 | 10.58 | 8.68 | 7.31 | 6.28 | 5.48 | 4.84 | 4.32 | 3.89 | 3.52 | 3.20 | 2.93 | 2.69 |

**Table A8.** Maximum daily efficiencies for latitudes [0°, 65°]; slope angles [16°, 30°].

|    | 16   | 17   | 18   | 19   | 20   | 21   | 22   | 23   | 24   | 25   | 26   | 27   | 28   | 29   | 30   |
|----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 0  | 1.21 | 1.26 | 1.31 | 1.37 | 1.42 | 1.48 | 1.55 | 1.62 | 1.69 | 1.77 | 1.85 | 1.94 | 2.04 | 2.15 | 2.26 |
| 1  | 1.18 | 1.23 | 1.28 | 1.33 | 1.38 | 1.44 | 1.50 | 1.57 | 1.63 | 1.71 | 1.79 | 1.87 | 1.97 | 2.06 | 2.17 |
| 2  | 1.15 | 1.19 | 1.24 | 1.29 | 1.34 | 1.40 | 1.45 | 1.52 | 1.58 | 1.65 | 1.73 | 1.81 | 1.90 | 1.99 | 2.09 |
| 3  | 1.12 | 1.16 | 1.21 | 1.25 | 1.30 | 1.36 | 1.41 | 1.47 | 1.53 | 1.60 | 1.67 | 1.75 | 1.83 | 1.92 | 2.01 |
| 4  | 1.09 | 1.13 | 1.18 | 1.22 | 1.27 | 1.32 | 1.37 | 1.43 | 1.49 | 1.55 | 1.62 | 1.69 | 1.77 | 1.85 | 1.94 |
| 5  | 1.07 | 1.11 | 1.15 | 1.19 | 1.23 | 1.28 | 1.33 | 1.39 | 1.44 | 1.50 | 1.57 | 1.64 | 1.71 | 1.79 | 1.87 |
| 6  | 1.04 | 1.08 | 1.12 | 1.16 | 1.20 | 1.25 | 1.30 | 1.35 | 1.40 | 1.46 | 1.52 | 1.59 | 1.66 | 1.73 | 1.81 |
| 7  | 1.02 | 1.06 | 1.09 | 1.13 | 1.17 | 1.22 | 1.26 | 1.31 | 1.36 | 1.42 | 1.48 | 1.54 | 1.60 | 1.67 | 1.75 |
| 8  | 1.00 | 1.03 | 1.07 | 1.11 | 1.15 | 1.19 | 1.23 | 1.28 | 1.33 | 1.38 | 1.43 | 1.49 | 1.56 | 1.62 | 1.69 |
| 9  | 0.98 | 1.01 | 1.04 | 1.08 | 1.12 | 1.16 | 1.20 | 1.25 | 1.29 | 1.34 | 1.40 | 1.45 | 1.51 | 1.57 | 1.64 |
| 10 | 0.96 | 0.99 | 1.02 | 1.06 | 1.09 | 1.13 | 1.17 | 1.21 | 1.26 | 1.31 | 1.36 | 1.41 | 1.47 | 1.53 | 1.59 |
| 11 | 0.94 | 0.97 | 1.00 | 1.03 | 1.07 | 1.11 | 1.14 | 1.19 | 1.23 | 1.27 | 1.32 | 1.37 | 1.43 | 1.49 | 1.55 |
| 12 | 0.92 | 0.95 | 0.98 | 1.01 | 1.05 | 1.08 | 1.12 | 1.16 | 1.20 | 1.24 | 1.29 | 1.34 | 1.39 | 1.45 | 1.50 |
| 13 | 0.91 | 0.93 | 0.96 | 0.99 | 1.03 | 1.06 | 1.10 | 1.13 | 1.17 | 1.21 | 1.26 | 1.31 | 1.36 | 1.41 | 1.46 |
| 14 | 0.89 | 0.92 | 0.95 | 0.97 | 1.01 | 1.04 | 1.07 | 1.11 | 1.15 | 1.19 | 1.23 | 1.27 | 1.32 | 1.37 | 1.42 |
| 15 | 0.88 | 0.90 | 0.93 | 0.96 | 0.99 | 1.02 | 1.05 | 1.09 | 1.12 | 1.16 | 1.20 | 1.24 | 1.29 | 1.34 | 1.39 |
| 16 | 0.86 | 0.89 | 0.91 | 0.94 | 0.97 | 1.00 | 1.03 | 1.06 | 1.10 | 1.14 | 1.18 | 1.22 | 1.26 | 1.31 | 1.35 |
| 17 | 0.85 | 0.87 | 0.90 | 0.93 | 0.95 | 0.98 | 1.01 | 1.04 | 1.08 | 1.11 | 1.15 | 1.19 | 1.23 | 1.28 | 1.32 |
| 18 | 0.84 | 0.86 | 0.89 | 0.91 | 0.94 | 0.97 | 0.99 | 1.03 | 1.06 | 1.09 | 1.13 | 1.17 | 1.21 | 1.25 | 1.29 |
| 19 | 0.83 | 0.85 | 0.87 | 0.90 | 0.92 | 0.95 | 0.98 | 1.01 | 1.04 | 1.07 | 1.11 | 1.14 | 1.18 | 1.22 | 1.26 |
| 20 | 0.82 | 0.84 | 0.86 | 0.88 | 0.91 | 0.93 | 0.96 | 0.99 | 1.02 | 1.05 | 1.09 | 1.12 | 1.16 | 1.20 | 1.24 |
| 21 | 0.81 | 0.83 | 0.85 | 0.87 | 0.90 | 0.92 | 0.95 | 0.98 | 1.00 | 1.03 | 1.07 | 1.10 | 1.14 | 1.17 | 1.21 |
| 22 | 0.80 | 0.82 | 0.84 | 0.86 | 0.88 | 0.91 | 0.93 | 0.96 | 0.99 | 1.02 | 1.05 | 1.08 | 1.12 | 1.15 | 1.19 |
| 23 | 0.79 | 0.81 | 0.83 | 0.85 | 0.87 | 0.90 | 0.92 | 0.95 | 0.97 | 1.00 | 1.03 | 1.06 | 1.10 | 1.13 | 1.17 |
| 24 | 0.78 | 0.80 | 0.82 | 0.84 | 0.86 | 0.89 | 0.91 | 0.93 | 0.96 | 0.99 | 1.02 | 1.05 | 1.08 | 1.11 | 1.15 |
| 25 | 0.78 | 0.80 | 0.81 | 0.83 | 0.86 | 0.88 | 0.90 | 0.92 | 0.95 | 0.98 | 1.00 | 1.03 | 1.06 | 1.10 | 1.13 |
| 26 | 0.77 | 0.79 | 0.81 | 0.83 | 0.85 | 0.87 | 0.89 | 0.91 | 0.94 | 0.96 | 0.99 | 1.02 | 1.05 | 1.08 | 1.11 |
| 27 | 0.77 | 0.78 | 0.80 | 0.82 | 0.84 | 0.86 | 0.88 | 0.90 | 0.93 | 0.95 | 0.98 | 1.00 | 1.03 | 1.06 | 1.10 |
| 28 | 0.76 | 0.78 | 0.80 | 0.81 | 0.83 | 0.85 | 0.87 | 0.89 | 0.92 | 0.94 | 0.97 | 0.99 | 1.02 | 1.05 | 1.08 |
| 29 | 0.77 | 0.78 | 0.79 | 0.81 | 0.83 | 0.85 | 0.87 | 0.89 | 0.91 | 0.93 | 0.96 | 0.98 | 1.01 | 1.04 | 1.07 |
| 30 | 0.79 | 0.77 | 0.79 | 0.81 | 0.82 | 0.84 | 0.86 | 0.88 | 0.90 | 0.92 | 0.95 | 0.97 | 1.00 | 1.02 | 1.05 |
| 31 | 0.81 | 0.78 | 0.79 | 0.80 | 0.82 | 0.84 | 0.85 | 0.87 | 0.89 | 0.92 | 0.94 | 0.96 | 0.99 | 1.01 | 1.04 |
| 32 | 0.83 | 0.80 | 0.78 | 0.80 | 0.82 | 0.83 | 0.85 | 0.87 | 0.89 | 0.91 | 0.93 | 0.96 | 0.98 | 1.01 | 1.03 |

## Continued

|    |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 33 | 0.86 | 0.82 | 0.79 | 0.80 | 0.81 | 0.83 | 0.85 | 0.87 | 0.88 | 0.90 | 0.93 | 0.95 | 0.97 | 1.00 | 1.02 |
| 34 | 0.88 | 0.84 | 0.81 | 0.80 | 0.81 | 0.83 | 0.84 | 0.86 | 0.88 | 0.90 | 0.92 | 0.94 | 0.97 | 0.99 | 1.01 |
| 35 | 0.90 | 0.87 | 0.83 | 0.80 | 0.81 | 0.83 | 0.84 | 0.86 | 0.88 | 0.90 | 0.92 | 0.94 | 0.96 | 0.98 | 1.01 |
| 36 | 0.93 | 0.89 | 0.85 | 0.82 | 0.81 | 0.83 | 0.84 | 0.86 | 0.88 | 0.89 | 0.91 | 0.93 | 0.96 | 0.98 | 1.00 |
| 37 | 0.96 | 0.92 | 0.88 | 0.84 | 0.81 | 0.83 | 0.84 | 0.86 | 0.88 | 0.89 | 0.91 | 0.93 | 0.95 | 0.97 | 1.00 |
| 38 | 0.98 | 0.94 | 0.90 | 0.86 | 0.83 | 0.83 | 0.84 | 0.86 | 0.88 | 0.89 | 0.91 | 0.93 | 0.95 | 0.97 | 0.99 |
| 39 | 1.01 | 0.97 | 0.93 | 0.89 | 0.85 | 0.83 | 0.84 | 0.86 | 0.88 | 0.89 | 0.91 | 0.93 | 0.95 | 0.97 | 0.99 |
| 40 | 1.04 | 1.00 | 0.95 | 0.91 | 0.87 | 0.84 | 0.85 | 0.86 | 0.88 | 0.89 | 0.91 | 0.93 | 0.95 | 0.97 | 0.99 |
| 41 | 1.07 | 1.03 | 0.98 | 0.94 | 0.90 | 0.86 | 0.85 | 0.87 | 0.88 | 0.90 | 0.91 | 0.93 | 0.95 | 0.97 | 0.99 |
| 42 | 1.11 | 1.06 | 1.01 | 0.96 | 0.92 | 0.88 | 0.86 | 0.87 | 0.89 | 0.90 | 0.92 | 0.94 | 0.95 | 0.97 | 0.99 |
| 43 | 1.14 | 1.09 | 1.04 | 0.99 | 0.95 | 0.91 | 0.87 | 0.88 | 0.89 | 0.91 | 0.92 | 0.94 | 0.96 | 0.98 | 1.00 |
| 44 | 1.18 | 1.12 | 1.07 | 1.02 | 0.97 | 0.93 | 0.89 | 0.88 | 0.90 | 0.91 | 0.93 | 0.95 | 0.96 | 0.98 | 1.00 |
| 45 | 1.22 | 1.16 | 1.10 | 1.05 | 1.00 | 0.96 | 0.91 | 0.89 | 0.91 | 0.92 | 0.94 | 0.95 | 0.97 | 0.99 | 1.01 |
| 46 | 1.26 | 1.19 | 1.14 | 1.08 | 1.03 | 0.98 | 0.94 | 0.90 | 0.91 | 0.93 | 0.94 | 0.96 | 0.98 | 1.00 | 1.01 |
| 47 | 1.30 | 1.23 | 1.17 | 1.11 | 1.06 | 1.01 | 0.96 | 0.92 | 0.93 | 0.94 | 0.95 | 0.97 | 0.99 | 1.00 | 1.02 |
| 48 | 1.34 | 1.27 | 1.21 | 1.15 | 1.09 | 1.04 | 0.99 | 0.95 | 0.94 | 0.95 | 0.97 | 0.98 | 1.00 | 1.02 | 1.03 |
| 49 | 1.39 | 1.31 | 1.25 | 1.18 | 1.13 | 1.07 | 1.02 | 0.97 | 0.95 | 0.97 | 0.98 | 1.00 | 1.01 | 1.03 | 1.05 |
| 50 | 1.43 | 1.36 | 1.29 | 1.22 | 1.16 | 1.10 | 1.05 | 1.00 | 0.97 | 0.98 | 1.00 | 1.01 | 1.03 | 1.04 | 1.06 |
| 51 | 1.48 | 1.40 | 1.33 | 1.26 | 1.20 | 1.14 | 1.08 | 1.03 | 0.98 | 1.00 | 1.01 | 1.03 | 1.04 | 1.06 | 1.08 |
| 52 | 1.53 | 1.45 | 1.37 | 1.30 | 1.23 | 1.17 | 1.11 | 1.06 | 1.00 | 1.02 | 1.03 | 1.05 | 1.06 | 1.08 | 1.10 |
| 53 | 1.59 | 1.50 | 1.42 | 1.34 | 1.27 | 1.20 | 1.14 | 1.09 | 1.03 | 1.04 | 1.05 | 1.07 | 1.09 | 1.10 | 1.12 |
| 54 | 1.65 | 1.55 | 1.47 | 1.38 | 1.31 | 1.24 | 1.18 | 1.12 | 1.06 | 1.07 | 1.08 | 1.10 | 1.11 | 1.13 | 1.15 |
| 55 | 1.71 | 1.61 | 1.51 | 1.43 | 1.35 | 1.28 | 1.21 | 1.15 | 1.09 | 1.09 | 1.11 | 1.12 | 1.14 | 1.16 | 1.18 |
| 56 | 1.77 | 1.66 | 1.57 | 1.48 | 1.39 | 1.32 | 1.25 | 1.18 | 1.12 | 1.13 | 1.14 | 1.16 | 1.17 | 1.19 | 1.21 |
| 57 | 1.83 | 1.72 | 1.62 | 1.53 | 1.44 | 1.36 | 1.28 | 1.21 | 1.15 | 1.16 | 1.18 | 1.19 | 1.21 | 1.23 | 1.25 |
| 58 | 1.90 | 1.78 | 1.68 | 1.58 | 1.48 | 1.40 | 1.32 | 1.25 | 1.19 | 1.20 | 1.22 | 1.24 | 1.25 | 1.27 | 1.29 |
| 59 | 1.98 | 1.85 | 1.73 | 1.63 | 1.53 | 1.44 | 1.36 | 1.28 | 1.24 | 1.25 | 1.27 | 1.29 | 1.30 | 1.32 | 1.34 |
| 60 | 2.05 | 1.92 | 1.79 | 1.68 | 1.58 | 1.49 | 1.40 | 1.32 | 1.29 | 1.31 | 1.33 | 1.34 | 1.36 | 1.38 | 1.41 |
| 61 | 2.13 | 1.99 | 1.86 | 1.74 | 1.63 | 1.53 | 1.44 | 1.35 | 1.36 | 1.38 | 1.39 | 1.41 | 1.43 | 1.46 | 1.48 |
| 62 | 2.21 | 2.06 | 1.92 | 1.79 | 1.68 | 1.58 | 1.48 | 1.42 | 1.44 | 1.46 | 1.48 | 1.50 | 1.52 | 1.54 | 1.57 |
| 63 | 2.30 | 2.13 | 1.99 | 1.85 | 1.73 | 1.62 | 1.52 | 1.51 | 1.53 | 1.55 | 1.58 | 1.60 | 1.63 | 1.66 | 1.68 |
| 64 | 2.39 | 2.21 | 2.05 | 1.91 | 1.79 | 1.67 | 1.61 | 1.63 | 1.66 | 1.68 | 1.71 | 1.74 | 1.77 | 1.80 | 1.83 |
| 65 | 2.48 | 2.29 | 2.12 | 1.97 | 1.84 | 1.75 | 1.77 | 1.80 | 1.83 | 1.86 | 1.90 | 1.93 | 1.97 | 2.01 | 2.05 |

**Table A9.** Maximum daily efficiencies for latitudes [0°, 65°]; slope angles [31°, 45°].

|    | 31   | 32   | 33   | 34   | 35   | 36   | 37   | 38   | 39   | 40   | 41   | 42   | 43   | 44   | 45   |
|----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 0  | 2.38 | 2.52 | 2.66 | 2.82 | 3.00 | 3.19 | 3.41 | 3.65 | 3.92 | 4.22 | 4.56 | 4.96 | 5.42 | 5.96 | 6.60 |
| 1  | 2.29 | 2.41 | 2.55 | 2.69 | 2.86 | 3.03 | 3.23 | 3.45 | 3.69 | 3.97 | 4.28 | 4.63 | 5.04 | 5.51 | 6.06 |
| 2  | 2.20 | 2.31 | 2.44 | 2.58 | 2.73 | 2.89 | 3.07 | 3.27 | 3.50 | 3.74 | 4.02 | 4.34 | 4.70 | 5.11 | 5.60 |
| 3  | 2.11 | 2.22 | 2.34 | 2.47 | 2.61 | 2.76 | 2.93 | 3.11 | 3.32 | 3.54 | 3.80 | 4.08 | 4.40 | 4.77 | 5.19 |
| 4  | 2.03 | 2.14 | 2.25 | 2.37 | 2.50 | 2.64 | 2.79 | 2.96 | 3.15 | 3.36 | 3.59 | 3.85 | 4.14 | 4.47 | 4.84 |
| 5  | 1.96 | 2.06 | 2.16 | 2.27 | 2.40 | 2.53 | 2.67 | 2.83 | 3.00 | 3.19 | 3.40 | 3.64 | 3.90 | 4.20 | 4.53 |
| 6  | 1.89 | 1.98 | 2.08 | 2.19 | 2.30 | 2.42 | 2.56 | 2.70 | 2.86 | 3.04 | 3.23 | 3.45 | 3.69 | 3.96 | 4.26 |
| 7  | 1.83 | 1.92 | 2.01 | 2.11 | 2.21 | 2.33 | 2.45 | 2.59 | 2.74 | 2.90 | 3.08 | 3.28 | 3.50 | 3.74 | 4.01 |
| 8  | 1.77 | 1.85 | 1.94 | 2.03 | 2.13 | 2.24 | 2.36 | 2.48 | 2.62 | 2.77 | 2.94 | 3.12 | 3.32 | 3.54 | 3.79 |
| 9  | 1.71 | 1.79 | 1.87 | 1.96 | 2.06 | 2.16 | 2.27 | 2.39 | 2.52 | 2.66 | 2.81 | 2.98 | 3.16 | 3.37 | 3.59 |
| 10 | 1.66 | 1.73 | 1.81 | 1.90 | 1.98 | 2.08 | 2.18 | 2.30 | 2.42 | 2.55 | 2.69 | 2.85 | 3.02 | 3.21 | 3.41 |
| 11 | 1.61 | 1.68 | 1.75 | 1.83 | 1.92 | 2.01 | 2.11 | 2.21 | 2.32 | 2.45 | 2.58 | 2.73 | 2.88 | 3.06 | 3.25 |
| 12 | 1.57 | 1.63 | 1.70 | 1.78 | 1.86 | 1.94 | 2.03 | 2.13 | 2.24 | 2.35 | 2.48 | 2.61 | 2.76 | 2.92 | 3.10 |
| 13 | 1.52 | 1.58 | 1.65 | 1.72 | 1.80 | 1.88 | 1.97 | 2.06 | 2.16 | 2.27 | 2.38 | 2.51 | 2.65 | 2.80 | 2.96 |
| 14 | 1.48 | 1.54 | 1.60 | 1.67 | 1.74 | 1.82 | 1.90 | 1.99 | 2.09 | 2.19 | 2.30 | 2.42 | 2.54 | 2.68 | 2.84 |
| 15 | 1.44 | 1.50 | 1.56 | 1.62 | 1.69 | 1.77 | 1.84 | 1.93 | 2.02 | 2.11 | 2.22 | 2.33 | 2.45 | 2.58 | 2.72 |
| 16 | 1.41 | 1.46 | 1.52 | 1.58 | 1.64 | 1.71 | 1.79 | 1.87 | 1.95 | 2.04 | 2.14 | 2.25 | 2.36 | 2.48 | 2.61 |
| 17 | 1.37 | 1.42 | 1.48 | 1.54 | 1.60 | 1.67 | 1.74 | 1.81 | 1.89 | 1.98 | 2.07 | 2.17 | 2.28 | 2.39 | 2.52 |
| 18 | 1.34 | 1.39 | 1.44 | 1.50 | 1.56 | 1.62 | 1.69 | 1.76 | 1.84 | 1.92 | 2.00 | 2.10 | 2.20 | 2.31 | 2.42 |
| 19 | 1.31 | 1.36 | 1.41 | 1.46 | 1.52 | 1.58 | 1.64 | 1.71 | 1.78 | 1.86 | 1.94 | 2.03 | 2.13 | 2.23 | 2.34 |
| 20 | 1.28 | 1.33 | 1.38 | 1.43 | 1.48 | 1.54 | 1.60 | 1.67 | 1.73 | 1.81 | 1.89 | 1.97 | 2.06 | 2.16 | 2.26 |
| 21 | 1.26 | 1.30 | 1.35 | 1.39 | 1.45 | 1.50 | 1.56 | 1.62 | 1.69 | 1.76 | 1.83 | 1.91 | 2.00 | 2.09 | 2.19 |
| 22 | 1.23 | 1.27 | 1.32 | 1.36 | 1.41 | 1.47 | 1.52 | 1.58 | 1.64 | 1.71 | 1.78 | 1.86 | 1.94 | 2.03 | 2.12 |
| 23 | 1.21 | 1.25 | 1.29 | 1.34 | 1.38 | 1.43 | 1.49 | 1.54 | 1.60 | 1.67 | 1.74 | 1.81 | 1.89 | 1.97 | 2.06 |
| 24 | 1.19 | 1.22 | 1.27 | 1.31 | 1.35 | 1.40 | 1.45 | 1.51 | 1.57 | 1.63 | 1.69 | 1.76 | 1.84 | 1.91 | 2.00 |
| 25 | 1.16 | 1.20 | 1.24 | 1.28 | 1.33 | 1.37 | 1.42 | 1.48 | 1.53 | 1.59 | 1.65 | 1.72 | 1.79 | 1.86 | 1.94 |
| 26 | 1.15 | 1.18 | 1.22 | 1.26 | 1.30 | 1.35 | 1.40 | 1.45 | 1.50 | 1.55 | 1.61 | 1.68 | 1.74 | 1.82 | 1.89 |
| 27 | 1.13 | 1.16 | 1.20 | 1.24 | 1.28 | 1.32 | 1.37 | 1.42 | 1.47 | 1.52 | 1.58 | 1.64 | 1.70 | 1.77 | 1.85 |
| 28 | 1.11 | 1.15 | 1.18 | 1.22 | 1.26 | 1.30 | 1.34 | 1.39 | 1.44 | 1.49 | 1.55 | 1.60 | 1.67 | 1.73 | 1.80 |
| 29 | 1.10 | 1.13 | 1.16 | 1.20 | 1.24 | 1.28 | 1.32 | 1.37 | 1.41 | 1.46 | 1.52 | 1.57 | 1.63 | 1.69 | 1.76 |
| 30 | 1.08 | 1.12 | 1.15 | 1.18 | 1.22 | 1.26 | 1.30 | 1.34 | 1.39 | 1.44 | 1.49 | 1.54 | 1.60 | 1.66 | 1.72 |
| 31 | 1.07 | 1.10 | 1.13 | 1.17 | 1.20 | 1.24 | 1.28 | 1.32 | 1.37 | 1.41 | 1.46 | 1.51 | 1.57 | 1.63 | 1.69 |
| 32 | 1.06 | 1.09 | 1.12 | 1.15 | 1.19 | 1.22 | 1.26 | 1.30 | 1.34 | 1.39 | 1.44 | 1.49 | 1.54 | 1.59 | 1.65 |

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|           |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|-----------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| <b>33</b> | 1.05 | 1.08 | 1.11 | 1.14 | 1.17 | 1.21 | 1.25 | 1.28 | 1.33 | 1.37 | 1.41 | 1.46 | 1.51 | 1.57 | 1.62 |
| <b>34</b> | 1.04 | 1.07 | 1.10 | 1.13 | 1.16 | 1.20 | 1.23 | 1.27 | 1.31 | 1.35 | 1.39 | 1.44 | 1.49 | 1.54 | 1.60 |
| <b>35</b> | 1.03 | 1.06 | 1.09 | 1.12 | 1.15 | 1.18 | 1.22 | 1.25 | 1.29 | 1.33 | 1.38 | 1.42 | 1.47 | 1.52 | 1.57 |
| <b>36</b> | 1.03 | 1.05 | 1.08 | 1.11 | 1.14 | 1.17 | 1.21 | 1.24 | 1.28 | 1.32 | 1.36 | 1.40 | 1.45 | 1.50 | 1.55 |
| <b>37</b> | 1.02 | 1.05 | 1.07 | 1.10 | 1.13 | 1.16 | 1.20 | 1.23 | 1.27 | 1.30 | 1.34 | 1.39 | 1.43 | 1.48 | 1.53 |
| <b>38</b> | 1.02 | 1.04 | 1.07 | 1.10 | 1.13 | 1.16 | 1.19 | 1.22 | 1.26 | 1.29 | 1.33 | 1.37 | 1.42 | 1.46 | 1.51 |
| <b>39</b> | 1.02 | 1.04 | 1.06 | 1.09 | 1.12 | 1.15 | 1.18 | 1.21 | 1.25 | 1.28 | 1.32 | 1.36 | 1.40 | 1.45 | 1.49 |
| <b>40</b> | 1.01 | 1.04 | 1.06 | 1.09 | 1.12 | 1.14 | 1.17 | 1.21 | 1.24 | 1.27 | 1.31 | 1.35 | 1.39 | 1.43 | 1.48 |
| <b>41</b> | 1.01 | 1.04 | 1.06 | 1.09 | 1.11 | 1.14 | 1.17 | 1.20 | 1.23 | 1.27 | 1.30 | 1.34 | 1.38 | 1.42 | 1.47 |
| <b>42</b> | 1.01 | 1.04 | 1.06 | 1.09 | 1.11 | 1.14 | 1.17 | 1.20 | 1.23 | 1.26 | 1.30 | 1.34 | 1.37 | 1.41 | 1.46 |
| <b>43</b> | 1.02 | 1.04 | 1.06 | 1.09 | 1.11 | 1.14 | 1.17 | 1.20 | 1.23 | 1.26 | 1.29 | 1.33 | 1.37 | 1.41 | 1.45 |
| <b>44</b> | 1.02 | 1.04 | 1.07 | 1.09 | 1.11 | 1.14 | 1.17 | 1.20 | 1.23 | 1.26 | 1.29 | 1.33 | 1.37 | 1.40 | 1.45 |
| <b>45</b> | 1.03 | 1.05 | 1.07 | 1.09 | 1.12 | 1.14 | 1.17 | 1.20 | 1.23 | 1.26 | 1.29 | 1.33 | 1.36 | 1.40 | 1.44 |
| <b>46</b> | 1.03 | 1.05 | 1.08 | 1.10 | 1.12 | 1.15 | 1.18 | 1.20 | 1.23 | 1.26 | 1.30 | 1.33 | 1.37 | 1.40 | 1.44 |
| <b>47</b> | 1.04 | 1.06 | 1.08 | 1.11 | 1.13 | 1.16 | 1.18 | 1.21 | 1.24 | 1.27 | 1.30 | 1.33 | 1.37 | 1.41 | 1.45 |
| <b>48</b> | 1.05 | 1.07 | 1.09 | 1.12 | 1.14 | 1.16 | 1.19 | 1.22 | 1.25 | 1.28 | 1.31 | 1.34 | 1.38 | 1.41 | 1.45 |
| <b>49</b> | 1.07 | 1.09 | 1.11 | 1.13 | 1.15 | 1.18 | 1.20 | 1.23 | 1.26 | 1.29 | 1.32 | 1.35 | 1.38 | 1.42 | 1.46 |
| <b>50</b> | 1.08 | 1.10 | 1.12 | 1.14 | 1.17 | 1.19 | 1.21 | 1.24 | 1.27 | 1.30 | 1.33 | 1.36 | 1.40 | 1.43 | 1.47 |
| <b>51</b> | 1.10 | 1.12 | 1.14 | 1.16 | 1.18 | 1.21 | 1.23 | 1.26 | 1.29 | 1.32 | 1.35 | 1.38 | 1.41 | 1.45 | 1.49 |
| <b>52</b> | 1.12 | 1.14 | 1.16 | 1.18 | 1.20 | 1.23 | 1.25 | 1.28 | 1.31 | 1.33 | 1.37 | 1.40 | 1.43 | 1.47 | 1.50 |
| <b>53</b> | 1.14 | 1.16 | 1.18 | 1.20 | 1.22 | 1.25 | 1.27 | 1.30 | 1.33 | 1.36 | 1.39 | 1.42 | 1.45 | 1.49 | 1.53 |
| <b>54</b> | 1.16 | 1.18 | 1.21 | 1.23 | 1.25 | 1.27 | 1.30 | 1.33 | 1.36 | 1.38 | 1.42 | 1.45 | 1.48 | 1.52 | 1.56 |
| <b>55</b> | 1.19 | 1.21 | 1.24 | 1.26 | 1.28 | 1.31 | 1.33 | 1.36 | 1.39 | 1.42 | 1.45 | 1.48 | 1.52 | 1.55 | 1.59 |
| <b>56</b> | 1.23 | 1.25 | 1.27 | 1.29 | 1.32 | 1.34 | 1.37 | 1.40 | 1.42 | 1.46 | 1.49 | 1.52 | 1.56 | 1.59 | 1.63 |
| <b>57</b> | 1.27 | 1.29 | 1.31 | 1.33 | 1.36 | 1.38 | 1.41 | 1.44 | 1.47 | 1.50 | 1.53 | 1.57 | 1.60 | 1.64 | 1.68 |
| <b>58</b> | 1.31 | 1.33 | 1.36 | 1.38 | 1.41 | 1.43 | 1.46 | 1.49 | 1.52 | 1.55 | 1.59 | 1.62 | 1.66 | 1.70 | 1.74 |
| <b>59</b> | 1.37 | 1.39 | 1.41 | 1.44 | 1.46 | 1.49 | 1.52 | 1.55 | 1.58 | 1.62 | 1.65 | 1.69 | 1.73 | 1.77 | 1.81 |
| <b>60</b> | 1.43 | 1.45 | 1.48 | 1.50 | 1.53 | 1.56 | 1.59 | 1.62 | 1.66 | 1.69 | 1.73 | 1.77 | 1.81 | 1.86 | 1.90 |
| <b>61</b> | 1.50 | 1.53 | 1.56 | 1.59 | 1.62 | 1.65 | 1.68 | 1.71 | 1.75 | 1.79 | 1.83 | 1.87 | 1.92 | 1.96 | 2.01 |
| <b>62</b> | 1.60 | 1.63 | 1.65 | 1.69 | 1.72 | 1.75 | 1.79 | 1.83 | 1.87 | 1.91 | 1.95 | 2.00 | 2.05 | 2.10 | 2.15 |
| <b>63</b> | 1.71 | 1.75 | 1.78 | 1.81 | 1.85 | 1.89 | 1.93 | 1.97 | 2.02 | 2.06 | 2.11 | 2.16 | 2.22 | 2.28 | 2.34 |
| <b>64</b> | 1.87 | 1.90 | 1.94 | 1.98 | 2.03 | 2.07 | 2.12 | 2.17 | 2.22 | 2.27 | 2.33 | 2.39 | 2.45 | 2.52 | 2.59 |
| <b>65</b> | 2.09 | 2.14 | 2.18 | 2.23 | 2.29 | 2.34 | 2.40 | 2.46 | 2.52 | 2.59 | 2.66 | 2.74 | 2.82 | 2.90 | 2.99 |

**Table A10.** Maximum daily efficiencies for latitudes [0°, 65°]; slope angles [46°, 60°].

|    | 46   | 47   | 48   | 49    | 50    | 51    | 52    | 53    | 54    | 55     | 56        | 57      | 58        | 59      | 60        |
|----|------|------|------|-------|-------|-------|-------|-------|-------|--------|-----------|---------|-----------|---------|-----------|
| 0  | 7.37 | 8.32 | 9.52 | 11.07 | 13.17 | 16.16 | 20.75 | 28.70 | 45.85 | 109.93 | 23,736.88 | 3082.76 | 3438.41   | 3931.16 | 1442.46   |
| 1  | 6.72 | 7.51 | 8.49 | 9.73  | 11.35 | 13.54 | 16.69 | 21.60 | 30.27 | 49.79  | 134.17    | 4780.64 | 12,660.18 | 6690.16 | 2315.88   |
| 2  | 6.16 | 6.84 | 7.66 | 8.67  | 9.95  | 11.64 | 13.94 | 17.27 | 22.52 | 32.03  | 54.47     | 172.11  | 8046.00   | 2437.19 | 25,225.07 |
| 3  | 5.69 | 6.27 | 6.96 | 7.81  | 8.85  | 10.19 | 11.94 | 14.36 | 17.89 | 23.53  | 34.01     | 60.12   | 239.97    | 4683.88 | 5907.59   |
| 4  | 5.28 | 5.78 | 6.38 | 7.09  | 7.96  | 9.05  | 10.43 | 12.26 | 14.80 | 18.55  | 24.63     | 36.24   | 67.09     | 396.44  | 16,404.51 |
| 5  | 4.92 | 5.36 | 5.88 | 6.49  | 7.23  | 8.12  | 9.25  | 10.69 | 12.60 | 15.27  | 19.26     | 25.85   | 38.79     | 75.90   | 1142.37   |
| 6  | 4.60 | 4.99 | 5.45 | 5.98  | 6.61  | 7.37  | 8.29  | 9.46  | 10.95 | 12.96  | 15.78     | 20.03   | 27.19     | 41.74   | 87.39     |
| 7  | 4.32 | 4.67 | 5.07 | 5.54  | 6.09  | 6.73  | 7.51  | 8.47  | 9.68  | 11.24  | 13.34     | 16.32   | 20.87     | 28.68   | 45.17     |
| 8  | 4.07 | 4.39 | 4.74 | 5.16  | 5.63  | 6.19  | 6.86  | 7.66  | 8.66  | 9.91   | 11.54     | 13.74   | 16.90     | 21.78   | 30.35     |
| 9  | 3.85 | 4.13 | 4.45 | 4.82  | 5.24  | 5.73  | 6.31  | 6.99  | 7.82  | 8.85   | 10.15     | 11.85   | 14.18     | 17.53   | 22.79     |
| 10 | 3.64 | 3.90 | 4.19 | 4.52  | 4.90  | 5.33  | 5.83  | 6.42  | 7.13  | 7.99   | 9.05      | 10.41   | 12.19     | 14.64   | 18.20     |
| 11 | 3.46 | 3.70 | 3.96 | 4.26  | 4.59  | 4.98  | 5.42  | 5.94  | 6.55  | 7.28   | 8.16      | 9.27    | 10.68     | 12.55   | 15.13     |
| 12 | 3.29 | 3.51 | 3.75 | 4.02  | 4.32  | 4.67  | 5.06  | 5.52  | 6.05  | 6.67   | 7.43      | 8.35    | 9.49      | 10.97   | 12.93     |
| 13 | 3.14 | 3.34 | 3.56 | 3.81  | 4.08  | 4.39  | 4.75  | 5.15  | 5.62  | 6.16   | 6.81      | 7.58    | 8.54      | 9.73    | 11.27     |
| 14 | 3.00 | 3.19 | 3.39 | 3.62  | 3.87  | 4.15  | 4.46  | 4.83  | 5.24  | 5.72   | 6.28      | 6.95    | 7.75      | 8.74    | 9.98      |
| 15 | 2.88 | 3.05 | 3.23 | 3.44  | 3.67  | 3.93  | 4.21  | 4.54  | 4.91  | 5.33   | 5.83      | 6.40    | 7.09      | 7.93    | 8.95      |
| 16 | 2.76 | 2.92 | 3.09 | 3.28  | 3.49  | 3.73  | 3.99  | 4.28  | 4.62  | 5.00   | 5.43      | 5.94    | 6.54      | 7.25    | 8.11      |
| 17 | 2.65 | 2.80 | 2.96 | 3.14  | 3.33  | 3.55  | 3.79  | 4.05  | 4.36  | 4.70   | 5.09      | 5.53    | 6.06      | 6.67    | 7.41      |
| 18 | 2.55 | 2.69 | 2.84 | 3.00  | 3.18  | 3.38  | 3.60  | 3.85  | 4.12  | 4.43   | 4.78      | 5.18    | 5.64      | 6.18    | 6.82      |
| 19 | 2.46 | 2.59 | 2.73 | 2.88  | 3.05  | 3.23  | 3.44  | 3.66  | 3.91  | 4.19   | 4.51      | 4.87    | 5.28      | 5.75    | 6.31      |
| 20 | 2.37 | 2.50 | 2.63 | 2.77  | 2.93  | 3.10  | 3.29  | 3.49  | 3.72  | 3.98   | 4.27      | 4.59    | 4.96      | 5.38    | 5.87      |
| 21 | 2.29 | 2.41 | 2.53 | 2.67  | 2.81  | 2.97  | 3.15  | 3.34  | 3.55  | 3.79   | 4.05      | 4.34    | 4.68      | 5.06    | 5.49      |
| 22 | 2.22 | 2.33 | 2.45 | 2.57  | 2.71  | 2.86  | 3.02  | 3.20  | 3.39  | 3.61   | 3.85      | 4.12    | 4.42      | 4.77    | 5.16      |
| 23 | 2.15 | 2.25 | 2.36 | 2.48  | 2.61  | 2.75  | 2.90  | 3.07  | 3.25  | 3.45   | 3.67      | 3.92    | 4.20      | 4.51    | 4.86      |
| 24 | 2.09 | 2.19 | 2.29 | 2.40  | 2.52  | 2.65  | 2.80  | 2.95  | 3.12  | 3.31   | 3.51      | 3.74    | 3.99      | 4.28    | 4.60      |
| 25 | 2.03 | 2.12 | 2.22 | 2.33  | 2.44  | 2.56  | 2.70  | 2.84  | 3.00  | 3.18   | 3.37      | 3.58    | 3.81      | 4.07    | 4.36      |
| 26 | 1.97 | 2.06 | 2.16 | 2.26  | 2.36  | 2.48  | 2.61  | 2.74  | 2.89  | 3.05   | 3.23      | 3.43    | 3.64      | 3.88    | 4.15      |
| 27 | 1.92 | 2.01 | 2.10 | 2.19  | 2.29  | 2.40  | 2.52  | 2.65  | 2.79  | 2.94   | 3.11      | 3.29    | 3.49      | 3.71    | 3.96      |
| 28 | 1.88 | 1.95 | 2.04 | 2.13  | 2.23  | 2.33  | 2.44  | 2.57  | 2.70  | 2.84   | 3.00      | 3.17    | 3.35      | 3.56    | 3.79      |
| 29 | 1.83 | 1.91 | 1.99 | 2.07  | 2.17  | 2.27  | 2.37  | 2.49  | 2.61  | 2.75   | 2.89      | 3.05    | 3.23      | 3.42    | 3.63      |
| 30 | 1.79 | 1.86 | 1.94 | 2.02  | 2.11  | 2.21  | 2.31  | 2.42  | 2.53  | 2.66   | 2.80      | 2.95    | 3.11      | 3.29    | 3.49      |
| 31 | 1.75 | 1.82 | 1.90 | 1.97  | 2.06  | 2.15  | 2.25  | 2.35  | 2.46  | 2.58   | 2.71      | 2.85    | 3.01      | 3.18    | 3.36      |
| 32 | 1.72 | 1.78 | 1.85 | 1.93  | 2.01  | 2.10  | 2.19  | 2.29  | 2.39  | 2.51   | 2.63      | 2.77    | 2.91      | 3.07    | 3.24      |

**Continued**

|           |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|-----------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| <b>33</b> | 1.68 | 1.75 | 1.82 | 1.89 | 1.97 | 2.05 | 2.14 | 2.23 | 2.33 | 2.44 | 2.56 | 2.69 | 2.82 | 2.97 | 3.13 |
| <b>34</b> | 1.65 | 1.72 | 1.78 | 1.85 | 1.93 | 2.00 | 2.09 | 2.18 | 2.28 | 2.38 | 2.49 | 2.61 | 2.74 | 2.88 | 3.04 |
| <b>35</b> | 1.63 | 1.69 | 1.75 | 1.82 | 1.89 | 1.96 | 2.04 | 2.13 | 2.22 | 2.32 | 2.43 | 2.54 | 2.67 | 2.80 | 2.95 |
| <b>36</b> | 1.60 | 1.66 | 1.72 | 1.79 | 1.85 | 1.93 | 2.00 | 2.09 | 2.18 | 2.27 | 2.37 | 2.48 | 2.60 | 2.73 | 2.87 |
| <b>37</b> | 1.58 | 1.64 | 1.69 | 1.76 | 1.82 | 1.89 | 1.97 | 2.05 | 2.13 | 2.22 | 2.32 | 2.43 | 2.54 | 2.66 | 2.79 |
| <b>38</b> | 1.56 | 1.61 | 1.67 | 1.73 | 1.80 | 1.86 | 1.94 | 2.01 | 2.09 | 2.18 | 2.28 | 2.38 | 2.48 | 2.60 | 2.72 |
| <b>39</b> | 1.54 | 1.59 | 1.65 | 1.71 | 1.77 | 1.84 | 1.91 | 1.98 | 2.06 | 2.14 | 2.23 | 2.33 | 2.43 | 2.54 | 2.66 |
| <b>40</b> | 1.53 | 1.58 | 1.63 | 1.69 | 1.75 | 1.81 | 1.88 | 1.95 | 2.03 | 2.11 | 2.20 | 2.29 | 2.39 | 2.49 | 2.61 |
| <b>41</b> | 1.51 | 1.56 | 1.62 | 1.67 | 1.73 | 1.79 | 1.86 | 1.93 | 2.00 | 2.08 | 2.16 | 2.25 | 2.35 | 2.45 | 2.56 |
| <b>42</b> | 1.50 | 1.55 | 1.60 | 1.66 | 1.71 | 1.77 | 1.84 | 1.90 | 1.97 | 2.05 | 2.13 | 2.22 | 2.31 | 2.41 | 2.52 |
| <b>43</b> | 1.50 | 1.54 | 1.59 | 1.64 | 1.70 | 1.76 | 1.82 | 1.88 | 1.95 | 2.03 | 2.11 | 2.19 | 2.28 | 2.38 | 2.48 |
| <b>44</b> | 1.49 | 1.53 | 1.58 | 1.63 | 1.69 | 1.75 | 1.81 | 1.87 | 1.94 | 2.01 | 2.09 | 2.17 | 2.25 | 2.35 | 2.45 |
| <b>45</b> | 1.49 | 1.53 | 1.58 | 1.63 | 1.68 | 1.74 | 1.80 | 1.86 | 1.92 | 1.99 | 2.07 | 2.15 | 2.23 | 2.32 | 2.42 |
| <b>46</b> | 1.48 | 1.53 | 1.58 | 1.62 | 1.68 | 1.73 | 1.79 | 1.85 | 1.91 | 1.98 | 2.06 | 2.13 | 2.22 | 2.30 | 2.40 |
| <b>47</b> | 1.49 | 1.53 | 1.58 | 1.62 | 1.67 | 1.73 | 1.78 | 1.84 | 1.91 | 1.98 | 2.05 | 2.12 | 2.20 | 2.29 | 2.38 |
| <b>48</b> | 1.49 | 1.53 | 1.58 | 1.63 | 1.68 | 1.73 | 1.79 | 1.84 | 1.91 | 1.97 | 2.04 | 2.12 | 2.20 | 2.28 | 2.37 |
| <b>49</b> | 1.50 | 1.54 | 1.59 | 1.63 | 1.68 | 1.73 | 1.79 | 1.85 | 1.91 | 1.98 | 2.04 | 2.12 | 2.20 | 2.28 | 2.37 |
| <b>50</b> | 1.51 | 1.55 | 1.60 | 1.64 | 1.69 | 1.74 | 1.80 | 1.86 | 1.92 | 1.98 | 2.05 | 2.12 | 2.20 | 2.28 | 2.37 |
| <b>51</b> | 1.53 | 1.57 | 1.61 | 1.66 | 1.71 | 1.76 | 1.81 | 1.87 | 1.93 | 1.99 | 2.06 | 2.13 | 2.21 | 2.29 | 2.38 |
| <b>52</b> | 1.54 | 1.59 | 1.63 | 1.68 | 1.72 | 1.78 | 1.83 | 1.89 | 1.95 | 2.01 | 2.08 | 2.15 | 2.23 | 2.31 | 2.40 |
| <b>53</b> | 1.57 | 1.61 | 1.65 | 1.70 | 1.75 | 1.80 | 1.85 | 1.91 | 1.97 | 2.04 | 2.10 | 2.18 | 2.25 | 2.33 | 2.42 |
| <b>54</b> | 1.60 | 1.64 | 1.68 | 1.73 | 1.78 | 1.83 | 1.89 | 1.94 | 2.00 | 2.07 | 2.14 | 2.21 | 2.29 | 2.37 | 2.45 |
| <b>55</b> | 1.63 | 1.67 | 1.72 | 1.77 | 1.82 | 1.87 | 1.92 | 1.98 | 2.04 | 2.11 | 2.18 | 2.25 | 2.33 | 2.41 | 2.50 |
| <b>56</b> | 1.67 | 1.72 | 1.76 | 1.81 | 1.86 | 1.91 | 1.97 | 2.03 | 2.09 | 2.16 | 2.23 | 2.30 | 2.38 | 2.47 | 2.56 |
| <b>57</b> | 1.72 | 1.77 | 1.82 | 1.86 | 1.92 | 1.97 | 2.03 | 2.09 | 2.15 | 2.22 | 2.30 | 2.37 | 2.45 | 2.54 | 2.63 |
| <b>58</b> | 1.79 | 1.83 | 1.88 | 1.93 | 1.98 | 2.04 | 2.10 | 2.16 | 2.23 | 2.30 | 2.38 | 2.46 | 2.54 | 2.63 | 2.73 |
| <b>59</b> | 1.86 | 1.91 | 1.96 | 2.01 | 2.07 | 2.13 | 2.19 | 2.26 | 2.33 | 2.40 | 2.48 | 2.56 | 2.65 | 2.74 | 2.85 |
| <b>60</b> | 1.95 | 2.00 | 2.05 | 2.11 | 2.17 | 2.23 | 2.30 | 2.37 | 2.44 | 2.52 | 2.61 | 2.70 | 2.79 | 2.89 | 3.00 |
| <b>61</b> | 2.06 | 2.12 | 2.18 | 2.24 | 2.30 | 2.37 | 2.44 | 2.52 | 2.60 | 2.68 | 2.77 | 2.87 | 2.97 | 3.08 | 3.20 |
| <b>62</b> | 2.21 | 2.27 | 2.33 | 2.40 | 2.47 | 2.54 | 2.62 | 2.71 | 2.80 | 2.89 | 2.99 | 3.10 | 3.21 | 3.34 | 3.47 |
| <b>63</b> | 2.40 | 2.47 | 2.54 | 2.61 | 2.69 | 2.78 | 2.87 | 2.97 | 3.07 | 3.18 | 3.29 | 3.42 | 3.55 | 3.69 | 3.84 |
| <b>64</b> | 2.67 | 2.75 | 2.83 | 2.92 | 3.02 | 3.12 | 3.23 | 3.34 | 3.46 | 3.60 | 3.74 | 3.89 | 4.05 | 4.23 | 4.42 |
| <b>65</b> | 3.09 | 3.19 | 3.30 | 3.41 | 3.53 | 3.66 | 3.80 | 3.96 | 4.12 | 4.29 | 4.48 | 4.68 | 4.91 | 5.15 | 5.41 |

**Table A11.** Maximum daily efficiencies for latitudes [0°, 65°]; slope angles [61°, 75°].

|    | 61      | 62     | 63   | 64     | 65     | 66      | 67     | 68     | 69     | 70     | 71     | 72     | 73     | 74     | 75     |
|----|---------|--------|------|--------|--------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 0  | 1147    | 2027   | 1044 | 15,029 | 5112   | 6542    | 915    | 15,020 | 1167   | 775    | 724    | 876    | 1695   | 3872   | 721    |
| 1  | 1900    | 5494   | 1750 | 31,407 | 1171   | 954     | 1581   | 2676   | 1374   | 772    | 1006   | 971    | 719    | 1013   | 10,915 |
| 2  | 1558    | 17,036 | 1848 | 2674   | 977    | 2017    | 2070   | 929    | 2886   | 773    | 1436   | 2226   | 1857   | 1053   | 722    |
| 3  | 25,458  | 1521   | 2265 | 1671   | 1450   | 6906    | 2367   | 2730   | 3398   | 935    | 1572   | 10,442 | 10,421 | 21,559 | 1969   |
| 4  | 4319    | 11,375 | 2411 | 1286   | 6248   | 3425    | 1182   | 1037   | 831    | 2041   | 1217   | 43,977 | 1975   | 1555   | 2236   |
| 5  | 46,851  | 1912   | 9359 | 7071   | 4100   | 1052    | 1293   | 2795   | 21,550 | 2829   | 793    | 9858   | 1461   | 900    | 838    |
| 6  | 219,219 | 10,569 | 4792 | 10,345 | 6174   | 3124    | 5260   | 4123   | 1576   | 1142   | 2005   | 2101   | 1608   | 741    | 916    |
| 7  | 103     | 9194   | 3561 | 12,730 | 17,245 | 2020    | 1106   | 1582   | 1210   | 1659   | 1823   | 902    | 3210   | 764    | 1386   |
| 8  | 49      | 126    | 5374 | 2719   | 2946   | 116,455 | 1229   | 3220   | 1942   | 4525   | 2541   | 2657   | 3947   | 905    | 1713   |
| 9  | 32      | 54     | 161  | 8139   | 70,588 | 1740    | 9760   | 2203   | 3205   | 2969   | 1170   | 1142   | 925    | 1649   | 1458   |
| 10 | 24      | 34     | 60   | 225    | 3210   | 2213    | 1904   | 4484   | 14,971 | 1082   | 1220   | 4492   | 7856   | 6676   | 966    |
| 11 | 19      | 25     | 37   | 68     | 372    | 54,480  | 15,297 | 2694   | 2705   | 2878   | 3626   | 16,757 | 1160   | 878    | 1269   |
| 12 | 16      | 20     | 26   | 40     | 77     | 1102    | 6004   | 1782   | 4149   | 1845   | 1268   | 2501   | 1034   | 4123   | 6266   |
| 13 | 13      | 16     | 21   | 28     | 43     | 91      | 12,175 | 4110   | 8082   | 7461   | 1353   | 1824   | 1169   | 4881   | 1171   |
| 14 | 12      | 14     | 17   | 22     | 30     | 47      | 109    | 12,569 | 4718   | 3348   | 20,197 | 1443   | 11,398 | 6346   | 1377   |
| 15 | 10      | 12     | 14   | 18     | 23     | 32      | 52     | 138    | 8888   | 13,789 | 1819   | 75,144 | 2080   | 2518   | 1769   |
| 16 | 9       | 11     | 12   | 15     | 18     | 24      | 34     | 58     | 188    | 3357   | 5720   | 5052   | 18,114 | 4061   | 1103   |
| 17 | 8       | 9      | 11   | 13     | 15     | 19      | 25     | 37     | 66     | 296    | 4292   | 1886   | 7372   | 12,992 | 98,564 |
| 18 | 8       | 9      | 10   | 11     | 13     | 16      | 20     | 27     | 40     | 76     | 701    | 11,989 | 7546   | 2211   | 12,593 |
| 19 | 7       | 8      | 9    | 10     | 12     | 14      | 17     | 21     | 28     | 43     | 90     | 15,661 | 5202   | 2653   | 1519   |
| 20 | 6       | 7      | 8    | 9      | 10     | 12      | 14     | 17     | 22     | 30     | 48     | 111    | 8274   | 2735   | 4413   |
| 21 | 6       | 7      | 7    | 8      | 9      | 11      | 12     | 15     | 18     | 23     | 33     | 54     | 145    | 13,830 | 2288   |
| 22 | 6       | 6      | 7    | 7      | 8      | 9       | 11     | 13     | 15     | 19     | 25     | 35     | 61     | 211    | 5245   |
| 23 | 5       | 6      | 6    | 7      | 8      | 9       | 10     | 11     | 13     | 16     | 20     | 26     | 39     | 71     | 388    |
| 24 | 5       | 5      | 6    | 6      | 7      | 8       | 9      | 10     | 12     | 14     | 17     | 21     | 28     | 43     | 85     |
| 25 | 5       | 5      | 5    | 6      | 7      | 7       | 8      | 9      | 10     | 12     | 14     | 17     | 22     | 30     | 48     |
| 26 | 4       | 5      | 5    | 6      | 6      | 7       | 7      | 8      | 9      | 11     | 13     | 15     | 18     | 24     | 33     |
| 27 | 4       | 5      | 5    | 5      | 6      | 6       | 7      | 8      | 9      | 10     | 11     | 13     | 16     | 19     | 25     |
| 28 | 4       | 4      | 5    | 5      | 5      | 6       | 6      | 7      | 8      | 9      | 10     | 12     | 14     | 16     | 20     |
| 29 | 4       | 4      | 4    | 5      | 5      | 6       | 6      | 7      | 7      | 8      | 9      | 10     | 12     | 14     | 17     |
| 30 | 4       | 4      | 4    | 5      | 5      | 5       | 6      | 6      | 7      | 8      | 8      | 9      | 11     | 13     | 15     |
| 31 | 4       | 4      | 4    | 4      | 5      | 5       | 5      | 6      | 6      | 7      | 8      | 9      | 10     | 11     | 13     |
| 32 | 3       | 4      | 4    | 4      | 4      | 5       | 5      | 6      | 6      | 7      | 7      | 8      | 9      | 10     | 12     |



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|    |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |
|----|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|
| 33 | 3 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 6  | 6  | 7  | 7  | 8  | 9  | 11 |
| 34 | 3 | 3 | 4 | 4 | 4 | 4 | 5 | 5 | 5  | 6  | 6  | 7  | 8  | 9  | 10 |
| 35 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 5 | 5  | 6  | 6  | 7  | 7  | 8  | 9  |
| 36 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 5 | 5  | 5  | 6  | 6  | 7  | 7  | 8  |
| 37 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 5  | 5  | 5  | 6  | 6  | 7  | 8  |
| 38 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 5  | 5  | 5  | 6  | 6  | 7  | 7  |
| 39 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4  | 5  | 5  | 5  | 6  | 6  | 7  |
| 40 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4  | 4  | 5  | 5  | 6  | 6  | 7  |
| 41 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4  | 4  | 5  | 5  | 5  | 6  | 6  |
| 42 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4  | 4  | 5  | 5  | 5  | 6  | 6  |
| 43 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4  | 4  | 4  | 5  | 5  | 5  | 6  |
| 44 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4  | 4  | 4  | 5  | 5  | 5  | 6  |
| 45 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4  | 4  | 4  | 4  | 5  | 5  | 5  |
| 46 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4  | 4  | 4  | 4  | 5  | 5  | 5  |
| 47 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4  | 4  | 4  | 4  | 5  | 5  | 5  |
| 48 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4  | 4  | 4  | 4  | 4  | 5  | 5  |
| 49 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4  | 4  | 4  | 4  | 4  | 5  | 5  |
| 50 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4  | 4  | 4  | 4  | 4  | 5  | 5  |
| 51 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4  | 4  | 4  | 4  | 4  | 5  | 5  |
| 52 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4  | 4  | 4  | 4  | 4  | 5  | 5  |
| 53 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4  | 4  | 4  | 4  | 4  | 5  | 5  |
| 54 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4  | 4  | 4  | 4  | 4  | 5  | 5  |
| 55 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4  | 4  | 4  | 4  | 4  | 5  | 5  |
| 56 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4  | 4  | 4  | 4  | 4  | 5  | 5  |
| 57 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4  | 4  | 4  | 4  | 4  | 5  | 5  |
| 58 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4  | 4  | 4  | 4  | 5  | 5  | 6  |
| 59 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4  | 4  | 5  | 5  | 5  | 5  | 6  |
| 60 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4  | 5  | 5  | 5  | 5  | 6  | 6  |
| 61 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 5 | 5  | 5  | 5  | 6  | 6  | 6  | 7  |
| 62 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5  | 6  | 6  | 6  | 7  | 7  | 8  |
| 63 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 6 | 6  | 6  | 7  | 7  | 8  | 8  | 9  |
| 64 | 5 | 5 | 5 | 5 | 6 | 6 | 6 | 7 | 7  | 8  | 8  | 9  | 10 | 11 | 12 |
| 65 | 6 | 6 | 6 | 7 | 7 | 8 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 16 | 19 |

**Table A12.** Maximum daily efficiencies for latitudes [0°, 65°]; slope angles [76°, 90°].

|    | 76     | 77     | 78     | 79     | 80     | 81      | 82      | 83     | 84        | 85     | 86     | 87     | 88     | 89      | 90     |
|----|--------|--------|--------|--------|--------|---------|---------|--------|-----------|--------|--------|--------|--------|---------|--------|
| 0  | 2365   | 861    | 3170   | 602    | 2109   | 1650    | 630     | 1033   | 5628      | 1835   | 825    | 595    | 908    | 1835    | Inf    |
| 1  | 924    | 1444   | 1074   | 1948   | 666    | 2962    | 1393    | 596    | 1110      | 7786   | 1725   | 810    | 599    | 912     | 1839   |
| 2  | 2262   | 1290   | 1039   | 1426   | 1405   | 747     | 4977    | 1205   | 601       | 1198   | 12,638 | 1628   | 795    | 604     | 917    |
| 3  | 785    | 1260   | 2136   | 811    | 2126   | 1098    | 852     | 15,630 | 1061      | 634    | 1302   | 33,612 | 1541   | 781     | 608    |
| 4  | 15,263 | 1137   | 872    | 6224   | 665    | 4181    | 901     | 991    | 13,649    | 948    | 671    | 1426   | 50,691 | 1462    | 768    |
| 5  | 1060   | 2644   | 2063   | 666    | 6765   | 687     | 135,471 | 764    | 1186      | 4740   | 856    | 712    | 1577   | 14,420  | 1391   |
| 6  | 876    | 694    | 1213   | 11,271 | 780    | 2185    | 843     | 4438   | 662       | 1476   | 2864   | 781    | 760    | 1763    | 8393   |
| 7  | 2048   | 1684   | 977    | 786    | 3235   | 1074    | 1300    | 1089   | 2178      | 619    | 1957   | 2049   | 717    | 814     | 2001   |
| 8  | 17,482 | 8490   | 22,804 | 1898   | 760    | 1410    | 1729    | 924    | 1544      | 1440   | 705    | 2909   | 1593   | 663     | 876    |
| 9  | 6920   | 1636   | 1374   | 1963   | 35,388 | 1150    | 899     | 4464   | 715       | 2658   | 1074   | 820    | 5696   | 1302    | 616    |
| 10 | 9133   | 1139   | 778    | 745    | 937    | 2111    | 2381    | 659    | 7551      | 665    | 9696   | 855    | 982    | 155,860 | 1100   |
| 11 | 5903   | 1097   | 918    | 1213   | 1108   | 763     | 1020    | 30,935 | 835       | 2034   | 840    | 5819   | 710    | 1223    | 6102   |
| 12 | 1430   | 1423   | 1097   | 2845   | 6749   | 3492    | 1332    | 671    | 2048      | 1263   | 1171   | 1142   | 2227   | 606     | 1627   |
| 13 | 1161   | 4051   | 1032   | 9654   | 2549   | 1874    | 2984    | 5337   | 982       | 1054   | 2605   | 820    | 1795   | 1372    | 699    |
| 14 | 3628   | 2161   | 831    | 11,424 | 1405   | 874     | 818     | 1038   | 2625      | 1976   | 707    | 36,058 | 629    | 4231    | 989    |
| 15 | 2162   | 1197   | 1751   | 3226   | 1246   | 878     | 1170    | 1088   | 760       | 1046   | 95,019 | 819    | 2255   | 801     | 11,433 |
| 16 | 1398   | 2044   | 3157   | 1286   | 1520   | 1117    | 3179    | 10,432 | 4472      | 1465   | 686    | 1877   | 1326   | 1158    | 1138   |
| 17 | 2131   | 39,921 | 1390   | 1231   | 3674   | 1137    | 139,992 | 1926   | 1489      | 2087   | 23,535 | 1140   | 942    | 3543    | 776    |
| 18 | 3477   | 18,836 | 1267   | 3990   | 2777   | 910     | 9608    | 1086   | 737       | 739    | 839    | 1652   | 3441   | 675     | 5132   |
| 19 | 15,781 | 1708   | 1674   | 1904   | 1018   | 1266    | 33,633  | 908    | 1253      | 1964   | 1743   | 1024   | 792    | 3302    | 1056   |
| 20 | 2460   | 33,648 | 1107   | 1220   | 3974   | 259,577 | 2500    | 949    | 2204      | 7638   | 2865   | 4644   | 3931   | 957     | 1105   |
| 21 | 2298   | 5900   | 48,489 | 1615   | 3744   | 952     | 988     | 1291   | 3037      | 1780   | 931    | 819    | 984    | 2094    | 2645   |
| 22 | 2461   | 8873   | 18,475 | 11,531 | 3344   | 3285    | 3260    | 3873   | 2326      | 1286   | 989    | 1513   | 1490   | 973     | 819    |
| 23 | 5860   | 3647   | 1535   | 3767   | 5967   | 26,438  | 1117    | 2002   | 1315      | 1293   | 1611   | 36,203 | 3312   | 4602    | 4750   |
| 24 | 2685   | 2501   | 24,536 | 4919   | 2147   | 3814    | 2561    | 1696   | 1117      | 1840   | 2258   | 1947   | 922    | 780     | 892    |
| 25 | 106    | 8170   | 54,839 | 3407   | 3505   | 1524    | 2707    | 1319   | 1,353,239 | 11,821 | 2074   | 1261   | 1115   | 2015    | 2157   |
| 26 | 54     | 141    | 31,368 | 2927   | 1902   | 1398    | 1193    | 2048   | 1154      | 1648   | 1346   | 1163   | 2319   | 3719    | 1700   |
| 27 | 36     | 62     | 214    | 10,982 | 2200   | 18,221  | 3679    | 1420   | 1620      | 1971   | 1059   | 1405   | 5926   | 1188    | 869    |
| 28 | 27     | 40     | 74     | 448    | 3229   | 2608    | 1942    | 5941   | 1749      | 1323   | 7288   | 2900   | 8859   | 823     | 2586   |
| 29 | 22     | 29     | 45     | 92     | 22,006 | 3145    | 2464    | 4240   | 1646      | 2251   | 1109   | 4119   | 3753   | 1050    | 5275   |
| 30 | 18     | 23     | 32     | 51     | 121    | 235,491 | 2861    | 1920   | 2151      | 1638   | 3125   | 1067   | 1583   | 1124    | 1737   |
| 31 | 16     | 19     | 25     | 36     | 60     | 181     | 9727    | 18,303 | 1787      | 3855   | 4859   | 5071   | 1223   | 972     | 1301   |
| 32 | 14     | 17     | 21     | 27     | 40     | 72      | 361     | 5395   | 2641      | 3047   | 1761   | 4938   | 13,477 | 1439    | 1302   |

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|    |    |    |    |    |    |     |        |         |        |        |         |      |           |        |         |
|----|----|----|----|----|----|-----|--------|---------|--------|--------|---------|------|-----------|--------|---------|
| 33 | 12 | 14 | 18 | 22 | 30 | 45  | 92     | 89,563  | 5180   | 2365   | 133,504 | 7300 | 1620      | 19,624 | 1750    |
| 34 | 11 | 13 | 15 | 19 | 24 | 33  | 53     | 127     | 22,796 | 10,803 | 4507    | 2489 | 1232      | 1252   | 5545    |
| 35 | 10 | 12 | 14 | 16 | 20 | 26  | 37     | 64      | 208    | 6143   | 4331    | 9815 | 1585      | 8455   | 2471    |
| 36 | 9  | 11 | 12 | 14 | 17 | 22  | 29     | 43      | 80     | 600    | 10,645  | 1985 | 16,323    | 8529   | 1687    |
| 37 | 9  | 10 | 11 | 13 | 15 | 19  | 24     | 32      | 50     | 110    | 10,432  | 9255 | 73,402    | 10,164 | 2081    |
| 38 | 8  | 9  | 10 | 12 | 14 | 16  | 20     | 26      | 37     | 61     | 177     | 8818 | 4361      | 1945   | 4727    |
| 39 | 8  | 8  | 9  | 11 | 12 | 15  | 17     | 22      | 29     | 43     | 79      | 473  | 1,789,923 | 2958   | 2625    |
| 40 | 7  | 8  | 9  | 10 | 11 | 13  | 16     | 19      | 24     | 33     | 51      | 112  | 459,66    | 4059   | 4592    |
| 41 | 7  | 8  | 8  | 9  | 11 | 12  | 14     | 17      | 21     | 27     | 38      | 64   | 199       | 6405   | 26,894  |
| 42 | 7  | 7  | 8  | 9  | 10 | 11  | 13     | 15      | 18     | 23     | 31      | 46   | 88        | 968    | 7542    |
| 43 | 6  | 7  | 8  | 8  | 9  | 10  | 12     | 14      | 16     | 20     | 26      | 36   | 57        | 141    | 373,279 |
| 44 | 6  | 7  | 7  | 8  | 9  | 10  | 11     | 13      | 15     | 18     | 22      | 30   | 43        | 78     | 377     |
| 45 | 6  | 6  | 7  | 8  | 8  | 9   | 10     | 12      | 14     | 16     | 20      | 25   | 35        | 55     | 123     |
| 46 | 6  | 6  | 7  | 7  | 8  | 9   | 10     | 11      | 13     | 15     | 18      | 22   | 29        | 43     | 76      |
| 47 | 6  | 6  | 6  | 7  | 8  | 9   | 9      | 11      | 12     | 14     | 17      | 20   | 26        | 35     | 56      |
| 48 | 5  | 6  | 6  | 7  | 7  | 8   | 9      | 10      | 12     | 13     | 16      | 19   | 23        | 31     | 45      |
| 49 | 5  | 6  | 6  | 7  | 7  | 8   | 9      | 10      | 11     | 13     | 15      | 17   | 21        | 27     | 38      |
| 50 | 5  | 6  | 6  | 7  | 7  | 8   | 9      | 10      | 11     | 12     | 14      | 16   | 20        | 25     | 34      |
| 51 | 5  | 6  | 6  | 6  | 7  | 8   | 8      | 9       | 10     | 12     | 14      | 16   | 19        | 24     | 31      |
| 52 | 5  | 6  | 6  | 6  | 7  | 8   | 8      | 9       | 10     | 12     | 13      | 15   | 18        | 22     | 29      |
| 53 | 5  | 6  | 6  | 6  | 7  | 8   | 8      | 9       | 10     | 11     | 13      | 15   | 18        | 22     | 28      |
| 54 | 5  | 6  | 6  | 6  | 7  | 8   | 8      | 9       | 10     | 11     | 13      | 15   | 18        | 21     | 27      |
| 55 | 5  | 6  | 6  | 7  | 7  | 8   | 8      | 9       | 10     | 12     | 13      | 15   | 18        | 22     | 27      |
| 56 | 5  | 6  | 6  | 7  | 7  | 8   | 9      | 10      | 11     | 12     | 13      | 16   | 18        | 22     | 28      |
| 57 | 6  | 6  | 6  | 7  | 8  | 8   | 9      | 10      | 11     | 12     | 14      | 16   | 19        | 24     | 30      |
| 58 | 6  | 6  | 7  | 7  | 8  | 9   | 9      | 10      | 12     | 13     | 15      | 17   | 21        | 26     | 34      |
| 59 | 6  | 7  | 7  | 8  | 8  | 9   | 10     | 11      | 13     | 14     | 16      | 19   | 24        | 30     | 41      |
| 60 | 7  | 7  | 8  | 8  | 9  | 10  | 11     | 12      | 14     | 16     | 19      | 23   | 28        | 38     | 56      |
| 61 | 7  | 8  | 9  | 9  | 10 | 11  | 13     | 14      | 16     | 19     | 23      | 29   | 38        | 56     | 106     |
| 62 | 8  | 9  | 10 | 11 | 12 | 13  | 15     | 18      | 21     | 25     | 32      | 44   | 68        | 151    | 7135    |
| 63 | 10 | 11 | 12 | 13 | 15 | 18  | 21     | 25      | 31     | 42     | 63      | 125  | 3445      | 3465   | 4183    |
| 64 | 13 | 15 | 17 | 19 | 23 | 28  | 37     | 51      | 84     | 235    | 4167    | 1858 | 4692      | 2196   | 2169    |
| 65 | 22 | 27 | 33 | 45 | 68 | 136 | 15,967 | 102,916 | 3060   | 1838   | 2304    | 1718 | 11,459    | 27,719 | 2484    |