Maximum Ampacities for Wire

The table to the right shows allowable ampacities of conductors (wires) in conduit, raceway, cable or directly buried, based on ambient temperature of 30°C (86°F). National Electrical Code (NEC) allows rounding up cable ampacity to next size standard fuse or breaker.

For ambient temperatures above 30°C (86°F), multiply the allowable ampacities shown at right by the correction factor listed under the insulation temperature rating below.

Temperature Range		75°F insulation	90°F insulation
31-35°C	87-95F	0.94	0.96
36-40°C	96-104F	0.88	0.91
41-45°C	105-113F	0.82	0.87
46-50°C	114-122F	0.75	0.82
51-55°C	123-131F	0.67	0.76
56-60°C	132-140F	0.58	0.71

Wire Size	Copper conductor temp. rating		Aluminum cond. temp. rating	
	75°C (167°F)	90°C (194°F)	75°C (167°F)	90°C (194°F)
*14	20	25		
*12	25	30	20	25
*10	35	40	30	35
8	50	55	40	45
6	65	75	50	60
4	85	95	65	75
2	115	130	90	100
1	130	150	100	115
1/0	150	170	120	135
2/0	175	195	135	150
3/0	200	225	155	175
4/0	230	260	180	205

NEC specifies that the overcurrent protection device not exceed 30A for 10 AWG wire, 20A for 12 AWG wire and 15A for 14 AWG wire.

Recommended Inverter Cable and Overcurrent Protection

Use this table to decide cable size and fuse or breaker size for common inverter models. Smaller cable sizes can be used if fuse or breaker size is reduced but this can cause problems if the inverter is run near its maximum output wattage. Larger cables may be necessary if the distance from the inverter to the battery is greater than 10 feet.

We stock battery-to-inverter cables in #2, 2/0 and 4/0 AWG.

Inverter voltage	Continuous watts	Maximum inverter input amps	Fuse size (amps)	Circuit breaker (amps)	Wire size AWG
12-volt	600	80	80	80	2
	800	107	110	110	2
	1000	134	200	175	2/0
	1500	200	300	250	4/0
	2400	320	400	250	4/0
	2500	334	400	250	4/0
	2800	382	400	250	4/0
	3000	400	400	250	4/0
24-volt	600	40	50	50	8
	800	54	75	75	4
	1000	67	80	100	2
	1500	100	110	110	2/0
	2400	160	200	175	2/0
	2500	167	200	175	2/0
	3000	200	300	250	4/0
	3500	230	300	250	4/0
	4000	265	300	250	4/0
48-volt	3000	76	110	110	2/0
	3600	90	110	110	2/0
	4000	148	200	175	2/0
	5500	185	400	250	4/0

Wire Loss Tables - 12V and 24V

Use these tables to determine the maximum distance one-way in feet of various gauges of two-conductor copper wire from power source to load for 2% voltage drop in 12-volt and 24-volt system wiring. You can go twice the distance where a 4% loss is acceptable. Do not exceed the 2% drop for wire between PV modules and batteries. A 4% to 5% loss is acceptable between batteries and lighting circuits in most cases. Note that if you change an array from 12 volts to 24 volts and the wattage remains the same, then the current is cut in half. This allows you to go 4 times as far with the same wire gauge with the 24-volt array as you could with the 12-volt array.

AMPS	#14	#12	#10	#8	#6	#4	#2	1/0	2/0	4/0
12-volt System – 2% Voltage Drop										
1	45	70	115	180	290	456	720			
2	22.5	35	57.5	90	145	228	360	580	720	1060
4	10	17.5	27.5	45	72.5	114	180	290	360	580
6	7.5	12	17.5	30	47.5	75	120	193	243	380
8	5.5	8.5	15	22.5	35.5	57	90	145	180	290
10	4.5	7	12	18	28.5	45.5	72.5	115	145	230
15	3	4.5	7	12	19	30	48	76.5	96	150
20	2	3.5	5.5	9	14.5	22.5	36	57.5	72.5	116
25	1.8	2.8	4.5	7	11.5	18	29	46	58	92
30	1.5	2.4	3.5	6	9.5	15	24	38.5	48.5	77
40			2.8	4.5	7	11.5	18	29	36	56
50			2.3	3.6	5.5	9	14.5	23	29	46
100					2.9	4.6	7.2	11.5	14.5	23
150							4.8	7.7	9.7	15
200							3.6	5.8	7.3	11
24-volt System – 2% Voltage Drop										
1	90	140	230	360	580	912	1440			
2	45	70	115	180	290	456	720	1160	1440	2120
4	20	35	55	90	145	228	360	580	720	1160
6	15	24	35	60	95	150	240	386	486	760
8	11	17	30	45	71	114	180	290	360	580
10	9	14	24	36	57	91	145	230	290	460
15	6	9	14	24	38	60	96	153	192	300
20	4	7	11	18	29	45	72	115	145	232
25	3.6	5.6	9	14	23	36	58	92	116	184
30	3	4.8	7	12	19	30	48	77	97	154
40			5.6	9	14	23	36	58	72	112
50			4.6	7.2	11	18	29	46	58	92
100					5.8	9.2	14.4	23	29	46
150							9.6	15.4	19.4	30
200							7.2	11.6	14.6	22

Wire Loss Tables - 48V and 120V

Use these tables to determine the maximum distance one-way in feet of various gauge two-conductor copper wire from power source to load for 2% voltage drop in 48-volt and 120-volt system wiring. You can go twice the distance where a 4% loss is acceptable. Do not exceed the 2% drop for wire between PV modules and batteries. A 4 to 5% loss is acceptable between batteries and lighting circuits in most cases.

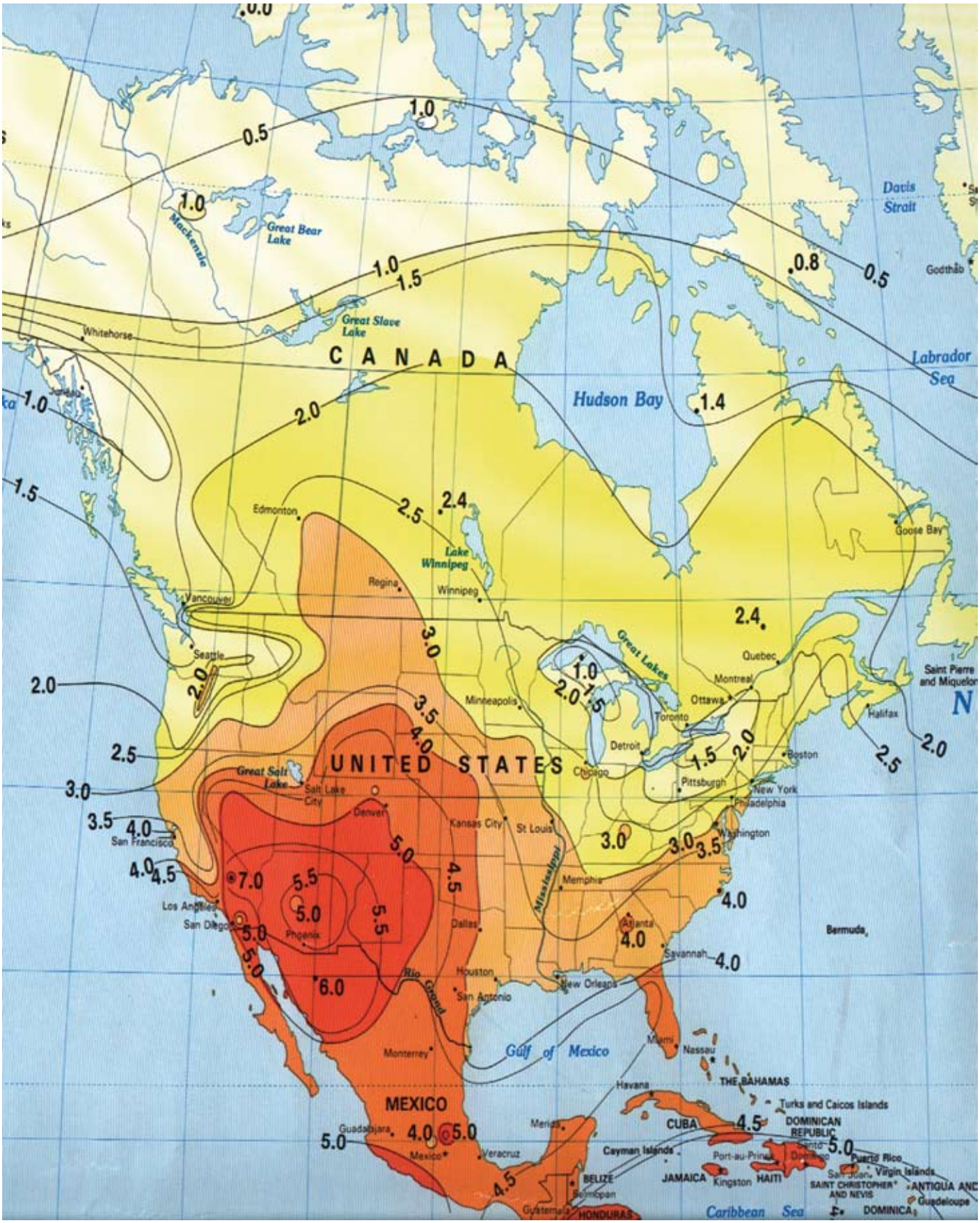
AMPS	#14	#12	#10	#8	#6	#4	#2	1/0	2/0	4/0
48-volt System – 2% Voltage Drop										
1	180	280	460	720	1160	1824	2880			
2	90	140	230	360	580	912	1440	2320	2880	4240
4	40	70	110	180	290	456	720	1160	1440	2320
6	30	48	70	120	190	300	480	772	972	1520
8	22	34	60	90	142	228	360	580	720	1160
10	18	28	48	72	114	182	290	460	580	920
15	12	18	28	48	76	120	192	306	384	600
20	8	14	22	36	58	90	144	230	290	464
25	7.2	11.2	18	28	46	72	116	184	232	368
30	6	9.6	14	24	38	60	96	154	194	308
40			11.2	18	28	46	72	116	144	224
50			9.2	14.4	22	36	58	92	116	184
100					11.6	18.4	28.8	46	58	92
150							19.2	30.8	38.8	60
200							14.4	23.2	29.2	44
120-volt System – 2% Voltage Drop										
1	450	700	1150	1800	2900	4560	7200	0	0	0
2	225	350	575	900	1450	2280	3600	5800	7200	10600
4	100	175	275	450	725	1140	1800	2900	3600	5800
6	75	120	175	300	475	750	1200	1930	2430	3800
8	55	85	150	225	355	570	900	1450	1800	2900
10	45	70	120	180	285	455	725	1150	1450	2300
15	30	45	70	120	190	300	480	765	960	1500
20	20	35	55	90	145	225	360	575	725	1160
25	18	28	45	70	115	180	290	460	580	920
30	15	24	35	60	95	150	240	385	485	770
40			28	45	70	115	180	290	360	560
50			23	36	55	90	145	230	290	460
100				18	29	46	72	115	145	230
150							48	77	97	150
200							36	58	73	110

Solar Insolation

This table shows solar insolation in kilowatt-hours per square meter per day in many U.S. locations. For simplicity, we call this figure "sun-hours per day." To find average sun-hours per day in your area (line 3 on page 8), check local weather data, look at the map on the page 14 or find a city in the table below that has similar weather to your location. If you want year-round autonomy, use the lowest of the two figures. If you want only 100% autonomy in summer, use the higher figure. If you want a utility grid-tie system, and you have net metering available in your state, use the average figures. World insolation maps are in the Reference section, beginning on the page.

State	City	High	Low	Avg
AK	Fairbanks	5.87	2.12	3.99
AK	Matanuska	5.24	1.74	3.55
AL	Montgomery	4.69	3.37	4.23
AR	Bethel	6.29	2.37	3.81
AR	Little Rock	5.29	3.88	4.69
AZ	Tucson	7.42	6.01	6.57
AZ	Page	7.30	5.65	6.36
AZ	Phoenix	7.13	5.78	6.58
CA	Santa Maria	6.52	5.42	5.94
CA	Riverside	6.35	5.35	5.87
CA	Davis	6.09	3.31	5.10
CA	Fresno	6.19	3.42	5.38
CA	Los Angeles	6.14	5.03	5.62
CA	Soda Springs	6.47	4.40	5.60
CA	La Jolla	5.24	4.29	4.77
CA	Inyokern	8.70	6.87	7.66
CO	Grandby	7.47	5.15	5.69
CO	Grand Lake	5.86	3.56	5.08
CO	Grand Junction	6.34	5.23	5.85
CO	Boulder	5.72	4.44	4.87
DC	Washington	4.69	3.37	4.23
FL	Apalachicola	5.98	4.92	5.49
FL	Belie Is.	5.31	4.58	4.99
FL	Miami	6.26	5.05	5.62
FL	Gainsville	5.81	4.71	5.27
FL	Tampa	6.16	5.26	5.67
GA	Atlanta	5.16	4.09	4.74
GA	Griffin	5.41	4.26	4.99
HI	Honolulu	6.71	5.59	6.02
IA	Ames	4.80	3.73	4.40
ID	Boise	5.83	3.33	4.92
ID	Twin Falls	5.42	3.42	4.70
IL	Chicago	4.08	1.47	3.14
IN	Indianapolis	5.02	2.55	4.21
KS	Manhattan	5.08	3.62	4.57
KS	Dodge City	6.50	4.20	5.60
KY	Lexington	5.97	3.60	4.94
LA	Lake Charles	5.73	4.29	4.93
LA	New Orleans	5.71	3.63	4.92
LA	Shreveport	4.99	3.87	4.63
MA	E. Wareham	4.48	3.06	3.99
MA	Boston	4.27	2.99	3.84
MA	Blue Hill	4.38	3.33	4.05
MA	Natick	4.62	3.09	4.10
MA	Lynn	4.60	2.33	3.79
MD	Silver Hill	4.71	3.84	4.47
ME	Caribou	5.62	2.57	4.19
ME	Portland	5.23	3.56	4.51
MI	Sault Ste. Marie	4.83	2.33	4.20
MI	E. Lansing	4.71	2.70	4.00
MN	St. Cloud	5.43	3.53	4.53
MO	Columbia	5.50	3.97	4.73
MO	St. Louis	4.87	3.24	4.38
MS	Meridian	4.86	3.64	4.43
MT	Glasgow	5.97	4.09	5.15
MT	Great Falls	5.70	3.66	4.93
MT	Summit	5.17	2.36	3.99
NM	Albuquerque	7.16	6.21	6.77
NB	Lincoln	5.40	4.38	4.79
NB	N. Omaha	5.28	4.26	4.90
NC	Cape Hatteras	5.81	4.69	5.31
NC	Greensboro	5.05	4.00	4.71
ND	Bismarck	5.48	3.97	5.01
NJ	Sea Brook	4.76	3.20	4.21
NV	Las Vegas	7.13	5.84	6.41
NV	Ely	6.48	5.49	5.98
NY	Binghampton	3.93	1.62	3.16
NY	Ithaca	4.57	2.29	3.79
NY	Schenectady	3.92	2.53	3.55
NY	Rochester	4.22	1.58	3.31
NY	New York City	4.97	3.03	4.08
OH	Columbus	5.26	2.66	4.15
OH	Cleveland	4.79	2.69	3.94
OK	Stillwater	5.52	4.22	4.99
OK	Oklahoma City	6.26	4.98	5.59
OR	Astoria	4.76	1.99	3.72
OR	Corvallis	5.71	1.90	4.03
OR	Medford	5.84	2.02	4.51
PA	Pittsburgh	4.19	1.45	3.28
PA	State College	4.44	2.79	3.91
RI	Newport	4.69	3.58	4.23
SC	Charleston	5.72	4.23	5.06
SD	Rapid City	5.91	4.56	5.23
TN	Nashville	5.20	3.14	4.45
TN	Oak Ridge	5.06	3.22	4.37
TX	San Antonio	5.88	4.65	5.30
TX	Brownsville	5.49	4.42	4.92
TX	El Paso	7.42	5.87	6.72
TX	Midland	6.33	5.23	5.83
TX	Fort Worth	6.00	4.80	5.43
UT	Salt Lake City	6.09	3.78	5.26
UT	Flaming Gorge	6.63	5.48	5.83
VA	Richmond	4.50	3.37	4.13
WA	Seattle	4.83	1.60	3.57
WA	Richland	6.13	2.01	4.44
WA	Pullman	6.07	2.90	4.73
WA	Spokane	5.53	1.16	4.48
WA	Prosser	6.21	3.06	5.03
WI	Madison	4.85	3.28	4.29
WV	Charleston	4.12	2.47	3.65
WY	Lander	6.81	5.50	6.06

These maps shows the average value of total solar energy received in peak sun hours per day on an optimally tilted surface during the month with the lowest solar radiation. This is the best number to use in system design where the electrical demand is continuous or is not expected to vary seasonally and the system must be designed to operate year around. (Use this number for line 3 in the Number-of-Modules Worksheet on page 14.)

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ARGENTINA
Mar del Plata
Bahía Blanca
CHILE
Stanley
Falkland Islands (Islas Malvinas)
South Georgia
Scotia Sea
SOUTH


North Sea
Baltic Sea
Black Sea
Caspian Sea
Aral Sea
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DENMARK
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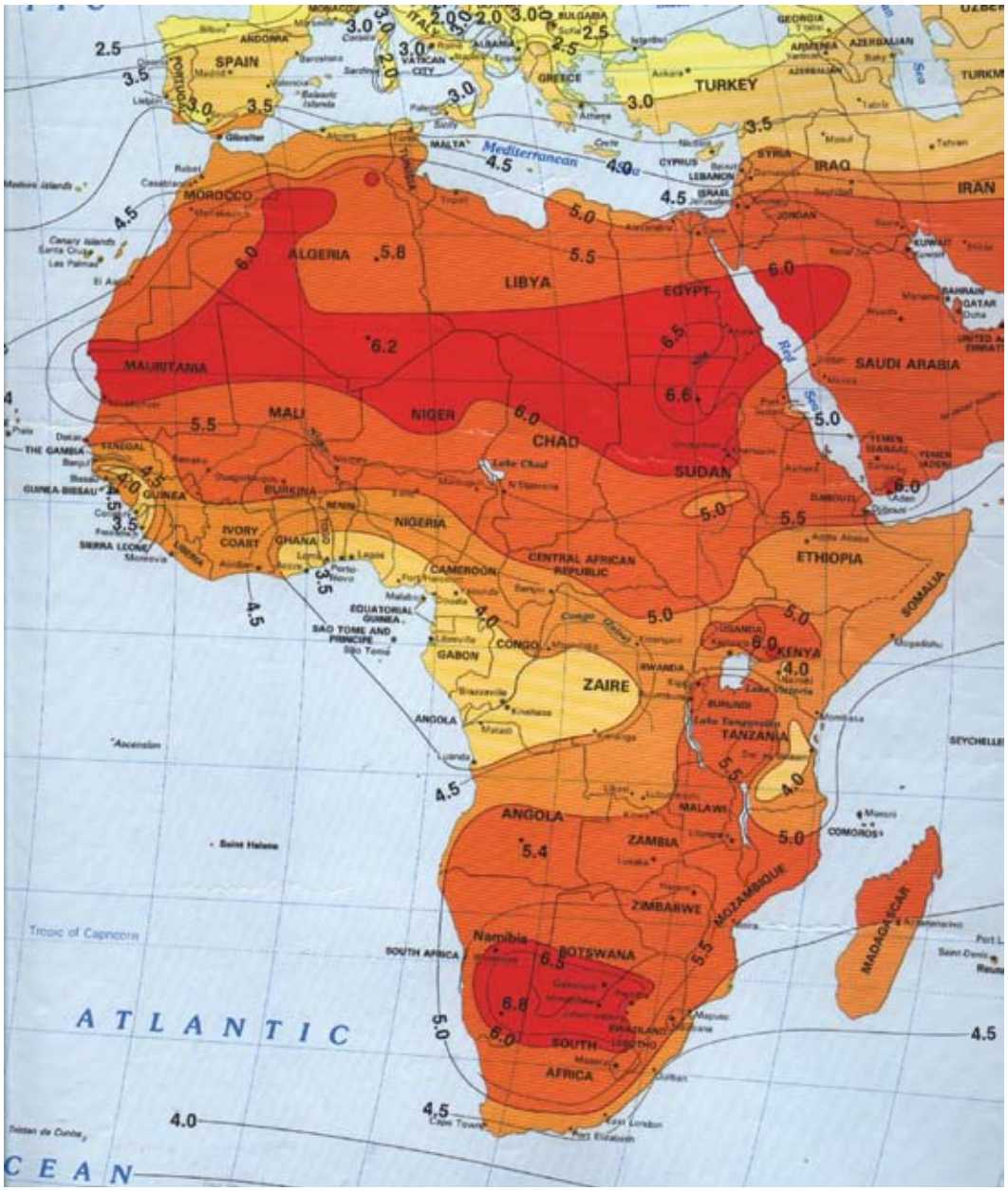
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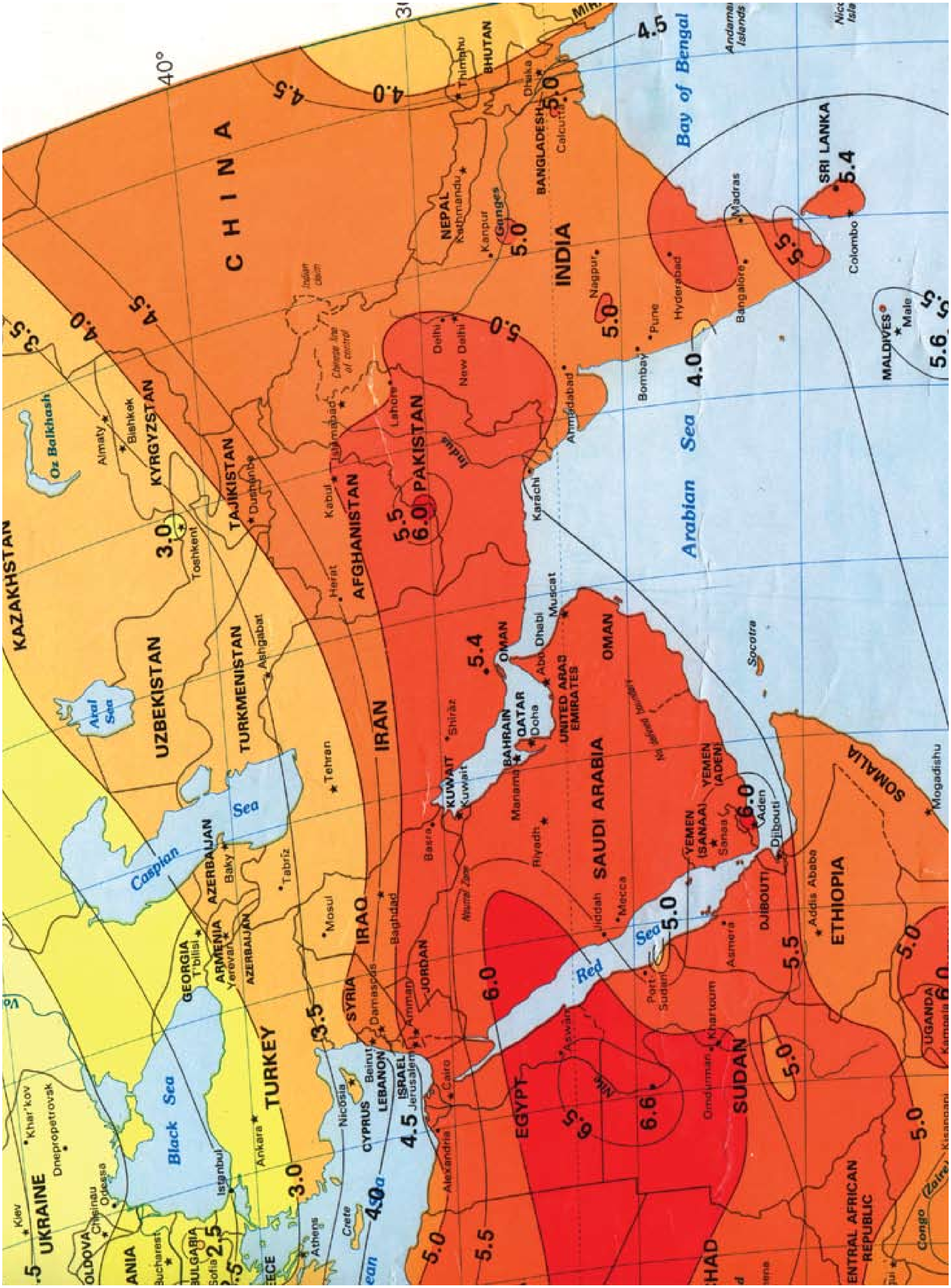
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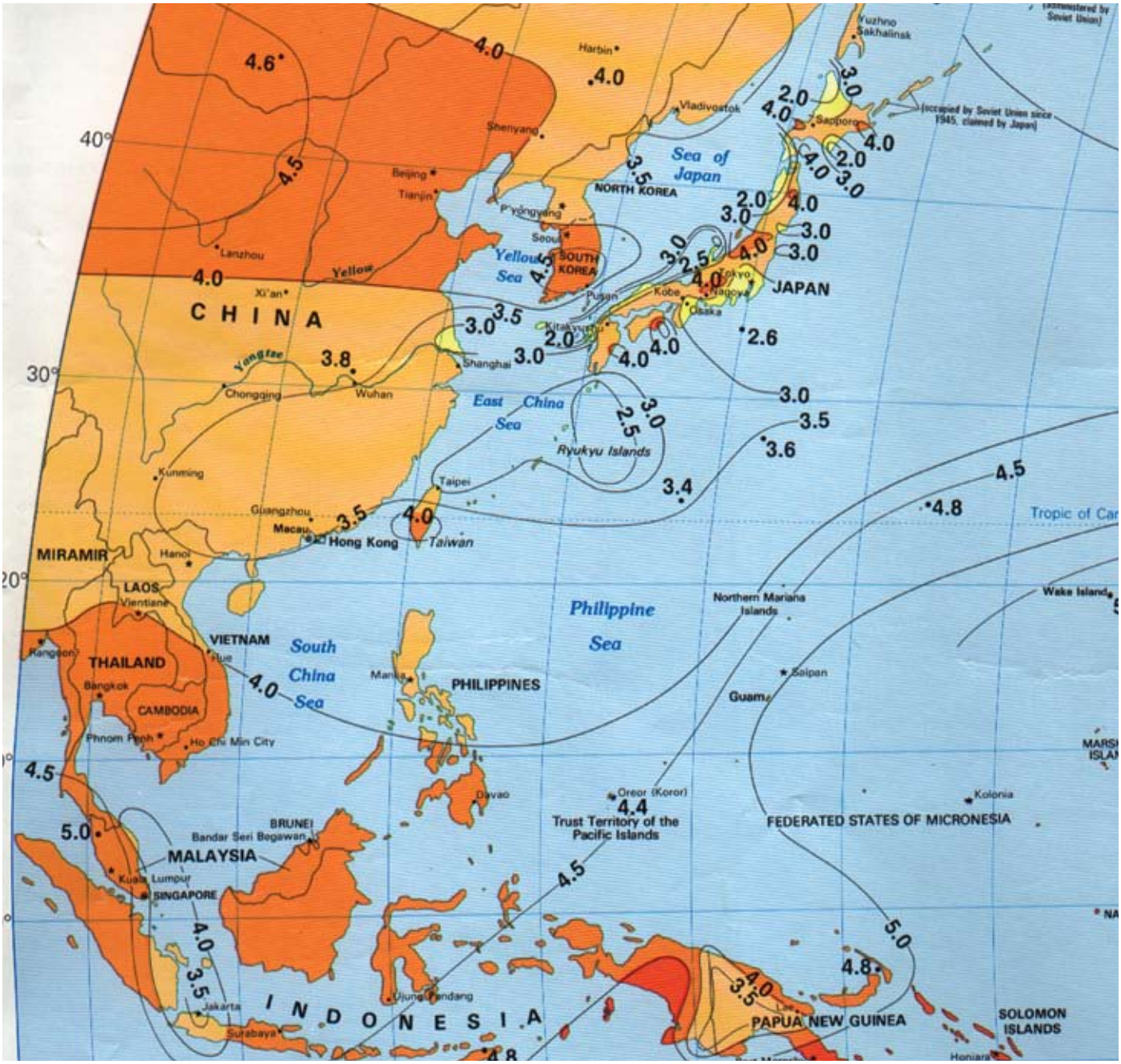
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South China Sea
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Macau
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Trust Territory of the Pacific Islands
FEDERATED STATES OF MICRONESIA
PAPUA NEW GUINEA
SOLOMON ISLANDS
Northern Mariana Islands
Guam
Saipan
Wake Island
Harbin
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Surabaya
Ujung Pandang
Kuala Lumpur
Bandar Seri Begawan
Oreor (Koror)
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Lae
Honiara
Yuzhno Sakhalinsk
(occupied by Soviet Union since 1945, claimed by Japan)
Tropic of Cancer
40°
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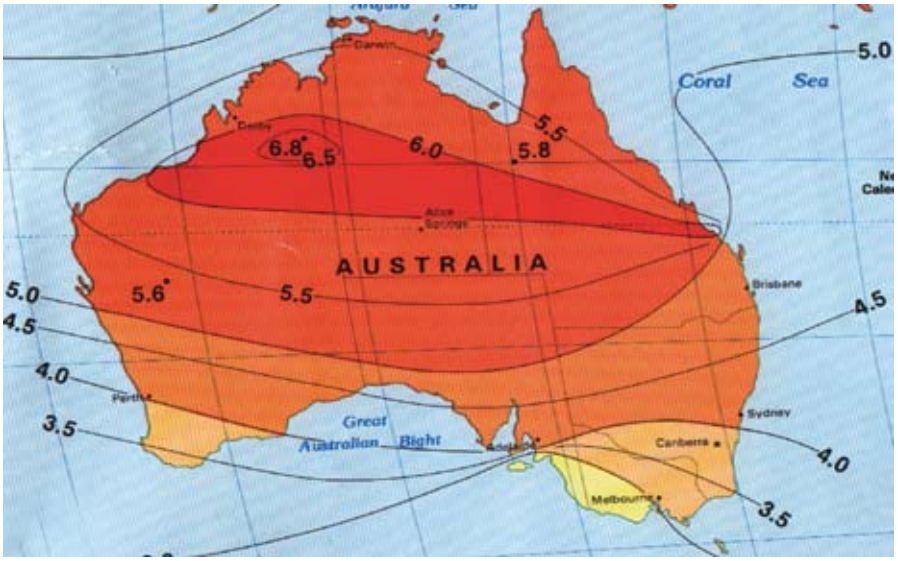
20°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Great Australian Bight
Darwin
Perth
Brisbane
Sydney
Canberra
Melbourne
Adelaide


NEW ZEALAND
Auckland
Wellington
Christchurch
Dunedin
Sea

Renewable Energy Glossary

absorbed glass mat (AGM): A fibrous silica glass mat to suspend the electrolyte in batteries. This mat provides pockets that assist in the recombination gasses generated during charging back into water.

alternating current (AC): Electric current in which the direction of flow is reversed at frequent intervals, usually 100 or 120 times per second (50 or 60 cycles per second or 50//60 Hz).

amorphous silicon: A non-crystalline semiconductor material that has no long-range order, often used in thin-film photovoltaic modules.

ampere (A) or amp: The unit for the electric current; the flow of electrons. One amp is 1coulomb passing in one second. One amp is produced by an electric force of 1 volt acting across a resistance of 1 ohm. Sometimes this is abbreviated as I for intensity.

ampere-hour (Ah): Quantity of electrical energy equal to the flow of one ampere of current for one hour. Typically used to quantify battery bank capacity.

array: Any number of photovoltaic modules connected together to provide a single electrical output at a specified voltage. Arrays are often designed to produce significant amounts of electricity.

autonomous system: A standalone PV system that has no backup generating source. May or may not include storage batteries.

avoided cost: The minimum amount an electric utility is required to pay an independent power producer, under the PURPA regulations of 1978, equal to the costs the utility calculates it avoids in not having to produce that power (usually substantially less than the retail price charged by the utility for power it sells to customers)

balance of system (BOS): All system components and costs other than the PV modules, including inverters, mounting structures, disconnects, wire and conduit.

battery: Two or more "cells" electrically connected for storing electrical energy. Common usage permits this designation to be applied also to a single cell used independently, as in a flashlight battery.

battery capacity: The total number of ampere-hours that can be withdrawn from a fully charged cell or battery.

battery cycle life: The number of cycles, to a specified depth of discharge, that a cell or battery can undergo before failing to meet its specified capacity or efficiency performance criteria.

battery self-discharge: The rate at which a battery, without a load, will lose its charge.

battery state of charge: Percentage of full charge, or100 percent minus the depth of discharge.

bypass diode: A diode connected across one or more solar cells in a photovoltaic module such that the diode will conduct if the cell(s) become reverse biased. Alternatively, a diode connected anti-parallel across a part of the solar cells of a PV module. It protects these solar cells from thermal destruction in case of total or partial shading of individual solar cells while other cells are exposed to full light.

cell: The basic unit of a photovoltaic module. This word is also commonly used to describe the basic unit of batteries (i.e., a 6-volt battery has three 2-volt cells).

charge controller: A device that controls the charging rate and/or state of charge for batteries.

charge rate: The current applied to a cell or battery to restore its available capacity.

compact fluorescent lights (CFL): Lights that use a lot less energy than regular light bulbs We can use compact fluorescent lights for reading lights and ceiling lights.

crystalline silicon: A type of PV cell made from a single crystal or polycrystalline slice of silicon.

current: The flow of electric charge in a conductor between two points having a difference in potential (voltage).

current at maximum power (Imp): The current at which maximum power is available from a module. [UL 1703]

cycle life: Number of discharge-charge cycles that a battery can tolerate under specified conditions before it fails to meet specified criteria as to performance (e.g., capacity decreases to 80-percent of the nominal capacity).

days of autonomy: The number of consecutive days a standalone system battery bank will meet a defined load without solar energy input.

DC to DC converter: Electronic circuit to convert DC voltages (e.g., PV module voltage) into other levels (e.g., load voltage). Can be part of a maximum power point tracker (MPPT).

deep cycle battery: Type of battery that can be discharged to a large fraction of capacity many times without damaging the battery.

depth of discharge (DOD): The amount of ampere hours removed from a fully charged cell or battery, expressed as a percentage of rated capacity.

diode: Electronic component that allows current flow in one direction only.

direct current (DC): Electric current in which electrons flow in one direction only. Opposite of alternating current.

discharge rate: The rate, usually expressed in amperes over time, at which electrical current is taken from the battery.

disconnect: Switch gear used to connect or disconnect components of a PV system for safety or service.

duty cycle: The ratio of active time to total time. Used to describe the operating regime of appliances or loads.

edge-defined film-fed growth (EFG): A method for making sheets of polycrystalline silicon in which molten silicon is drawn upward by capillary action through a mold.

efficiency: The ratio of output power to input power. Expressed as a percent.

electric circuit: Path followed by electrons from a power source (generator or battery) through an external line (including devices that use the electricity) and returning through another line to the source.

electric current: A flow of electrons; electricity.

electrical grid: An integrated system of electricity distribution, usually covering a large area; most typically in the USA, owned and operated by a public utility.

electrolyte: A liquid conductor of electricity in which flow of current takes place by migration of ions. The electrolyte for a lead-acid storage cell is an aqueous solution of sulfuric acid.

energy: The ability to do work. Stored energy becomes working energy when we use it.

energy density: The ratio of energy available from a battery to its volume (Wh/1) or mass (Wh/kg).

equalization: The process of mixing the electrolyte in batteries by periodically overcharging the batteries for a short period to "refresh" cell capacity.

float charge: Float charge is the voltage required to counteract the self-discharge of the battery at a certain temperature.

float life: Number of years that a battery can keep its stated capacity when it is kept at float charge.

gassing current: Portion of charge current that goes into electrolytical production of hydrogen and oxygen from the electrolytic liquid in the battery. This current increases with increasing voltage and temperature.

gel-type battery: Lead-acid battery in which the electrolyte is composed of a silica gel matrix.

gigawatt (gW): One billion watts. One million kilowatts. One thousand megawatts.

grid-tie: A PV, wind or hydroelectric systems that supplies power directly to the utility grid. Also called grid-connected, grid-interactive, utility-intertie and other similarly descriptive terms.

hybrid system: A PV system that includes other sources of electricity generation, such as wind or fossil fuel generators.

insolation: Sunlight, direct or diffuse; from 'incident solar radiation.' Usually expressed in watts per square meter. Not to be confused with 'insulation.'

interconnect: A conductor within a module or other means to provide an electrical connection between the solar cells.

inverter: Device that converts DC electricity into AC electricity (single or multiphase), either for off-grid standalone systems or for grid-tie systems.

junction box: An electrical box designed to be a safe enclosure in which to make proper electrical connections. On PV modules this is where PV strings are electrically connected.

kilowatt (kW): 1000 watts.

kilowatt-hour (kWh): One thousand watt-hours. The kWh is a unit of energy. 1 kWh=3600 kJ.

life cycle cost: An estimate of the cost of owning and operating a system for the period of its useful life; usually expressed in terms of the present value of all lifetime costs.

load: Anything in an electrical circuit that, when the circuit is turned on, draws power from that circuit.

maximum power point tracker (MPPT): Means of a power conditioning unit that automatically operates the PV generator at its MPP under all conditions.

megawatt (MW): One million watts; 1000 kilowatts.

module: See 'photovoltaic module.'

multicrystalline: Material that is solidified at such as rate that many small crystals (crystallites) form. The atoms within a single crystallite are symmetrically arranged, whereas crystallites are jumbled together. These numerous grain boundaries reduce the device efficiency. A material composed of variously oriented, small individual crystals. (Sometimes referred to as polycrystalline or semicrystalline).

NEC: An abbreviation for the National Electrical Code which contains safety guidelines and required practices for all types of electrical installations. Article 690 pertains to solar photovoltaic systems.

nominal operating cell temperature (NOCT): The reference cell (module) operating temperature presented on manufacturer's literature. Generally the NOCT is referenced at 25°C, 77°F.

nominal voltage: A reference voltage used to describe batteries, modules, or systems (i.e., a 12-, 24-, or 48-volt battery, module or system).

ohm: The unit of resistance to the flow of an electric current.

one-axis tracking: A system capable of rotating about one axis, also referred to as single axis. These tracking systems usually follow the sun from east to west throughout the day.

open-circuit voltage (Voc): The maximum possible voltage across a photovoltaic cell or module; the voltage across the cell in sunlight when no current is flowing.

orientation: Placement according to the compass directions, north, south, east, west.

parallel connection: A way of joining two or more electricity-producing devices such as PV cells or modules, or batteries by connecting positive leads together and negative leads together. Such a configuration increases the current but the voltage is constant.

peak load; peak demand: The maximum load, or usage, of electrical power occurring in a given period of time, typically a day.

peak sun hours: The equivalent number of hours per day when solar irradiance averages 1000 w/m2 (full sun).

photovoltaic (PV): Pertaining to the direct conversion of photons of sunlight into electricity.

photovoltaic array: An interconnected system of PV modules that function as a single electricity producing unit. The modules are assembled as a discrete structure, with common support or mounting. In smaller systems, an array can consist of a single module.

photovoltaic cell: The smallest semiconductor element within a PV module to perform the immediate conversion of light into electrical energy (DC voltage and current).

photovoltaic module: The smallest environmentally protected, essentially planar assembly of solar cells – including ancillary parts such as interconnections, terminals and protective devices such as diodes – intended to generate DC power under unconcentrated sunlight. The structural (load carrying) member of a module can either be the top layer (superstrate) or the back layer (substrate).

photovoltaic peak watt: Maximum "rated" output of a cell, module, or system. Typical rating conditions are 0.645 watts per square inch (1000 watts per square meter) of sunlight, 68 degrees F (20 degrees C) ambient air temperature and 6.2 x 10-3 mi/s (1m/s) wind speed.

photovoltaic system: A complete set of components for converting sunlight into electricity by the photovoltaic process, including the array and balance of system components.

polycrystalline: See 'multicrystalline.'

power factor: The ratio of the average power and the apparent volt-amperes.

pulse-width-modulated wave inverter (PWM): Pulse-width-modulated wave inverters are the most expensive, but produce a high quality of output signal at minimum current harmonics. The output voltage is very close to sinusoidal.

PV: Abbreviation for photovoltaic.

remote site: Site which is not located near the utility grid.

remote systems: Systems located away from the utility grid.

resistance (R): The property of a conductor which opposes the flow of an electric current resulting in the generation of heat in the conducting material. The unit of resistance is ohms.

satellite power system (SPS): Concept for providing large amounts of electricity for use on the Earth from one or more satellites in geosynchronous Earth orbit. A very large array of solar cells on each satellite would provide electricity, which would be converted to microwave energy and beamed to a receiving antenna on the ground. There, it would be reconverted into electricity and distributed the same as any other centrally generated power, through a grid.

series connection: A way of joining electrical equipment by connecting positive leads to negative leads; such a configuration increases the voltage while current remains the same.

series regulator: Type of battery charge regulator where the charging current is controlled by a switch connected in series with the PV module or array.

shelf life of batteries: The length of time, under specified conditions, that a battery can be stored so that it keeps its guaranteed capacity.

short-circuit current (Isc): The current flowing freely from a photovoltaic cell through an external circuit that has no load or resistance; the maximum current possible.

shunt regulator: Type of a battery charge regulator where the charging current is controlled by a switch connected in parallel with the PV generator. Overcharging of the battery is prevented by shorting the PV generator.

silicon (Si): A chemical element, atomic number 14, semi-metallic in nature, dark gray, an excellent semiconductor material. A common constituent of sand and quartz (as the oxide). Crystallizes in face centered cubic lattice – like a diamond. The most common semiconductor material used in making photovoltaic devices.

sine wave inverter: An inverter that produces utility quality, sine wave power forms.

single-crystal material: A material that is composed of a single crystal or a few large crystals.

solar cell: See 'photovoltaic cell.'

solar constant: The strength of sunlight; 1353 watts per square meter in space and about 1000 watts per square meter at sea level at the equator at solar noon.

solar energy: Energy from the sun. For example, the heat that builds up in your car when the windows are closed is solar energy.

solar-grade silicon: Intermediate-grade silicon used in the manufacture of solar cells. Less expensive than electronic-grade silicon used to make semiconductors.

square wave inverter: The inverter consists of a DC source, four switches, and the load. The switches are power semiconductors that can carry a large current and withstand a high voltage rating. The switches are turned on and off at a correct sequence, at a certain frequency. The square wave inverter is the simplest and the least expensive to purchase, but it produces the lowest quality of power.

Staebler-Wronski effect: The tendency of amorphous silicon photovoltaic devices to lose efficiency upon initial exposure to light; named for Dr. David Staebler and Dr. Christopher Wronski; work performed at RCA.

standalone: An autonomous or hybrid photovoltaic system not connected to a grid. Some standalone systems require batteries or some other form of storage. "Standalone" is virtually synonymous with "off-grid" when applied to energy systems.

stand-off mounting: Technique for mounting a PV array on a sloped roof, which involves mounting the modules a short distance above the pitched roof and tilting them to the optimum angle. This promotes air flow to cool the modules.

standard test conditions (STC): Conditions under which a module is typically tested in a laboratory: (1) Irradiance intensity of 1000 W/square meter (0.645 watts per square inch), (2) AM1.5 solar reference spectrum, and (3) a cell (module) temperature of 25°C, plus or minus 2 °C (77 °F, plus or minus 3.6 °F).

state of charge (SOC): The available capacity remaining in a cell or battery, expressed as a percentage of the rated capacity. For example, if 25 amp-hours have been removed from a fully charged 100 amp-hour cell, the state of charge is 75 percent.

sulfation: A condition that afflicts unused and discharged batteries; large crystals of lead sulfate grow on the plate, instead of the usual tiny crystals, making the battery extremely difficult to recharge.

superstrate: The covering on the sun side of a PV module, providing protection for the PV materials from impact and environmental degradation while allowing maximum transmission of the appropriate wavelengths of the solar spectrum.

surge: The momentary start-up condition of a motor requiring a large amount of current.

surge capacity: The ability of an inverter or generator to deliver high currents momentarily required when starting a motor.

temperature compensation: An allowance made in charge controller set points for changing battery temperatures.

thin film: A layer of semiconductor material, such as copper indium diselenide, cadmium telluride, gallium arsenide, or amorphous silicon, a few microns or less in thickness, used to make photovoltaic cells.

tilt angle: Angle of inclination of a module as measured in degrees from the horizontal. For maximum performance solar collectors/modules should be set as close as possible to perpendicular to the sun.

total harmonic distortion (thd): The measure of closeness in shape between a waveform and its fundamental component.

tracking PV array: PV array that follows the path of the sun to maximize the solar radiation incident on the PV surface. The two most common orientations are (1) one axis where the array tracks the sun east to west and (2) two-axis tracking where the array points directly at the sun at all times. Tracking arrays use both the direct and diffuse sunlight. Two-axis tracking arrays capture the maximum possible daily energy.

transformer: An electromagnetic device used to convert AC electricity, either to increase or decrease the voltage.

trickle charge: A charge at a low rate, balancing through self-discharge losses, to maintain a cell or battery in a fully charged condition.

two-axis tracking: A system capable of rotating independently about two axes and following the sun's orientation and height in the sky (e.g., vertical and horizontal).

utility-interactive inverter: An inverter that can function only when tied to the utility grid, and uses the prevailing line-voltage frequency on the utility line as a control parameter to ensure that the PV system's output is fully synchronized with the utility power.

VAC: Volts AC.

VDC: Volts DC.

Voc: Open-circuit voltage (seen entry).

volt (V): A unit of measure of the force, or 'push', given the electrons in an electric circuit. One volt produces one amp of current when acting against a resistance of one ohm.

voltage at maximum power (VMP): The voltage at which maximum power is available from a module.

wafer: A thin sheet of semiconductor material made by mechanically sawing it from a single-crystal or multicrystal ingot or casting.

watt (W): The unit of electric power, or amount of work. One ampere of current flowing at a potential of one volt produces one watt of power.

watt-hour (Wh): A quantity of electrical energy when one watt is used for one hour.

waveform: The shape of the curve graphically representing the change in the AC signal voltage and current amplitude, with respect to time.

This glossary was compiled with assistance and permission from Solar Energy International (SEI) and their book "Photovoltaics: Design and Installation Manual." See page 7 for information on SEI classes.

NOTES