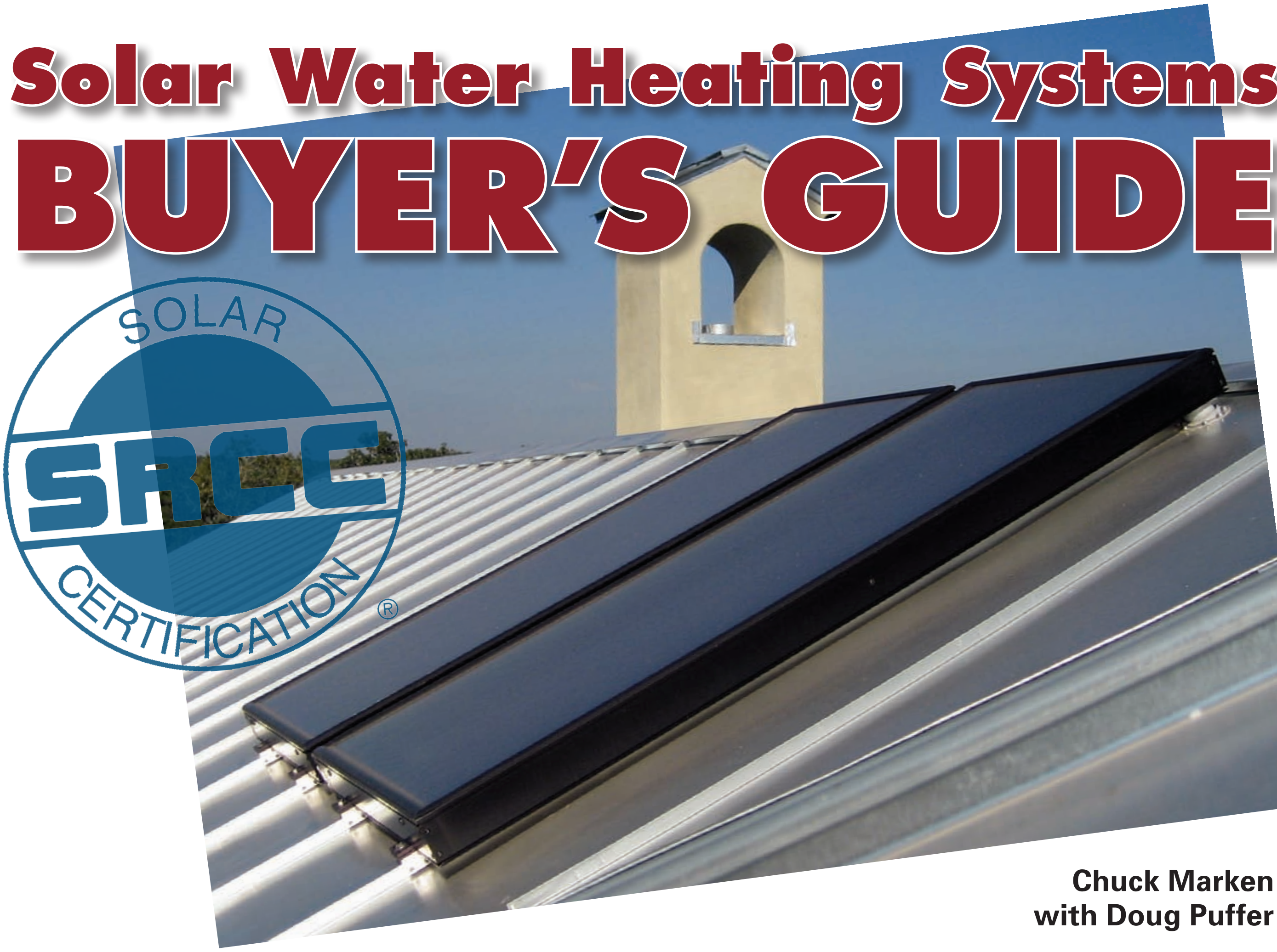
Solar Water Heating Systems BUYER'S GUIDE



Courtesy www.synergysolar.com

Chuck Marken
with Doug Puffer

For most of us, performance matters, whether we're shopping for a new car or choosing a solar water heating system. For cars, their estimated fuel economy—miles per gallon—can influence which model offers the best value. Although these EPA testing numbers aren't necessarily "real-world," they can give us a guideline to go by. Solar hot water (SHW) system performance is not much different. In this case, systems are evaluated by an independent testing agency—then certified by the Solar Rating and Certification Corp. (SRCC). And their ratings are the next best thing to real-world performance.

Considering Your Choices

Our list of solar water heating systems is condensed from the SRCC's Operating Guidelines 300 (OG-300) catalog, since we didn't have room to list the more than 500 SRCC certified systems. Instead, we tried to include every SHW system manufacturer, but pared the list to 130 individual systems, which were selected by two criteria: typical residential tank size (40 to 120 gallons) and typical collector sizing (1 square foot of collector area to every 1 to 2 gallons of water stored).

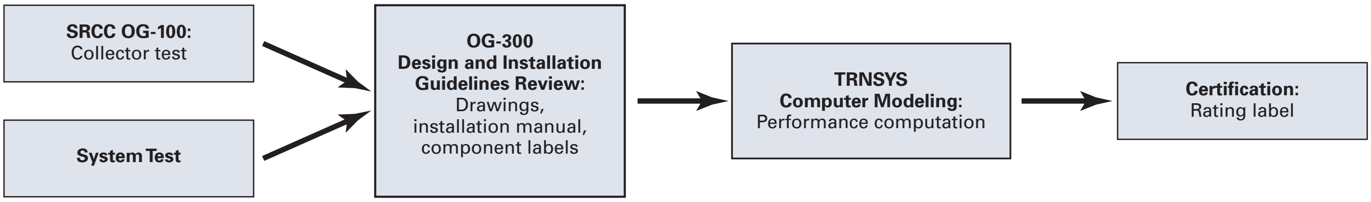
Only seven or eight efficient systems per manufacturer were included in each climate category. To compare apples to apples, all the systems listed in our table are assumed to have electric backup heating. The included data is current as of March 1, 2008—for updates, visit the SRCC Web site. If you want a more detailed look at all the systems, but don't want to wade through the SRCC's 309-page catalog, check out our complete spreadsheet of OG-300 systems at www.homepower.com.

System Certification

In *HP123*, we featured a guide to selecting a solar hot water collector—the "engine" of a SHW system that gathers the energy. While the collector is the *most* important component in a solar water heating system, it is only one component of several that work together. Once the energy is gathered, it needs to be stored for on-demand use. The other components of an SHW system facilitate the storage and distribution of the solar-heated water, and greatly influence how much hot water is available.

While choosing a collector is important, knowing how the entire system will perform is crucial. And getting an idea of how one system stacks up against another will help you maximize your investment. The SRCC OG-300 standards provide a relative performance comparison of various solar water heating systems. Certification requires testing the collectors under the OG-100 standard and testing the entire system. (Note that some collectors are integrated with the storage tank, such as integral collector and storage and thermosyphon systems, and are listed only in the OG-300 catalog.) Before a system can be certified, a design and installation review, and a performance computation must be completed.

SRCC's OG-300 Certification Process



Collectors and systems are tested under standard laboratory conditions that are certain to be different from those at your home. Testing is a combination of durability and performance, with the test procedures for performance specified by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE Standard 93, "Methods of Testing to Determine the Thermal Performance of Solar Collectors").

What's Your Climate?

Before you select a system, you'll need to classify your climate area as either "mild" or "harsh." For the purposes of the table (see page 96), we split the list according to each system's freeze tolerance—or lack of it—and set the dividing line at 10°F.

However, since water freezes under different conditions of temperature, pipe size, liquid flow, insulation, and time, there are no hard-and-fast divisions—it's very difficult to give a rule that will work everywhere under all conditions.

In "mild" climates, where freezing conditions are uncommon, potable water can be used directly in the collector loop. In SRCC lingo, this is a "Type I fluid system." These mild-climate systems have no heat exchangers, and are usually simpler and less expensive, with few components. However, because of their limited freeze tolerance, these systems, which include integrated collector storage (ICS) systems, direct forced-circulation systems, and open-loop thermosyphon units, are generally limited to installation in Hawaii and the southernmost part of the United States—states that border Mexico or the Gulf of Mexico.

The rest of the United States is classified as falling in the "harsh" climate, since the probability of freezing is far greater. These areas are best served with true freeze-tolerant systems, which have heat exchangers, and are either drainback systems that use potable water (Type I fluid system) or nontoxic antifreeze systems (Type II fluid system). The SRCC catalog refers to these systems as "indirect forced-circulation systems."

Solar Hot Water System-Types Compared

System Type	Climate & Description	Advantages	Disadvantages	Installation
Integral Collector Storage (ICS)	Passive: Open loop for mild climates	Simplicity; lowest cost	Poor freeze protection; poor tank insulation	Heavy units; easy to install; can have cosmetic-appearance issues
Thermosyphon	Passive: Open loop for mild climates; closed loop can be used in harsh climates	Simple open loop; tank is insulated	Open loop has poor freeze protection; closed loop needs a heat exchanger; potable water lines to collector subject to freezing	Very heavy systems; easy to install; can have cosmetic-appearance issues
Direct Pump: Direct circulation	Open loop for mild climates only	Simple active system; can be PV powered	Poor freeze protection; freeze valves can give false security	Easy installation; needs electrical source
Drainback: Closed loop, forced circulation	Closed loop for all climates	Simple system when compared to antifreeze systems; limited overheating	Needs a high-head pump and heat exchanger; harder to power with PV	Slope of collectors and piping is critical
Closed-Loop Antifreeze: Forced circulation	Closed loop for all climates	Best freeze protection; easily PV powered	Most complex; can have overheating problems; needs a heat exchanger	Most difficult installation

MILD CLIMATE SYSTEMS

Integral Collector Storage

Passive ICS systems (batch water heaters) are the simplest solar water heater. Cold water flows under normal water pressure to the bottom of the tank, and hot water is taken off the top. Whenever there's a call for hot water, hot water moves from the top of the solar batch heater as cold water is pushed into the bottom. Most of the ICS units produced in the United States today are progressive-tube-type heaters as opposed to single-tank units. Although the storage tank(s) of ICS systems are freeze-tolerant in normal operation, the weak point in the system is the potable water pipes running to and from the units. These systems are climate limited and are included in the mild-climate listings. (For more information on ICS systems, see *HP93* & *HP108*.)

Thermosyphon

These systems position an insulated solar storage tank higher than the collector, relying on the principle of heat rising to move water through the system. These open-loop systems are more climate-limited than ICS systems because the small riser tubes in the collector are vulnerable to freezing. However, thermosyphon systems can be configured in a closed-loop design, using antifreeze in the collector and a heat exchanger and potable water in the tank. Because closed-loop thermosyphon systems have potable domestic water lines to and from the collector, their Achilles' heel, they are vulnerable to freezing.

The advantage of this system over the batch heater is that solar heat is stored in a well-insulated tank, so hot water can be used any time with lesser penalty of overnight losses. The SRCC lists open-loop systems as "direct thermosyphon" and closed-loops as "indirect thermosyphon." (A direct thermosyphon system is described in detail in *HP97*.)

Direct Pump

Used in tropical settings where freezing never occurs, this is the simplest of the active systems, using a pump and a standard tank with electrical elements teamed with a solar thermal collector. A direct-pump system is also known as a "direct-forced circulation" system by SRCC classifications. In this open-loop system, the collector-loop fluid is potable water. As with ICS and open-loop thermosyphon systems, potable water must run outside to the collector, and the associated plumbing is vulnerable to freezing. A weaker freeze link is the smaller riser tubes connected to the header tubes. They are subject to freezing before the insulated potable water lines. Direct-pump systems can easily be married to a PV module that will power a DC pump. Direct forced-circulation systems are very popular in places like Hawaii, which has mild temperatures and plenty of sunshine.

Freeze-Protection Gizmos—Caveat Emptor

In an attempt to have their systems reclassified to gain more sales, some manufacturers have incorporated freeze-protection schemes into their "mild climate" systems. The bottom line? Buyer beware if you're considering installing one of these systems in your "harsh" climate. Only two designs—drainback and antifreeze systems—offer reliable freeze protection in these areas. Here are some freeze-protection devices that have caused collectors to freeze in the past —and consequently have required expensive repairs or replacement.

Direct pump with recirculation. Some differential controls for turning pumps on and off also have a "freeze-protection feature" that can be set to recirculate water from the storage tank to the collector. The logic is that the warmed, stored water can be routed to the collector to prevent it from freezing. But this method has ruined collectors when unusually bad winter storms move in and power outages occur. Without electricity to power the control and pump, water can stagnate in the collector, and a hard freeze can burst the collector riser tubes.

Freeze valves (a.k.a. dribble valves). For freeze protection, some direct-pump, ICS, and thermosyphon systems use a freeze valve, a passive valve that is set to open at a low temperature (either 35°F or 45°F). When the valve opens, water from the municipal or well system enters the collector, and the near-freezing water in the collector dribbles from the valve onto the roof or the ground. Although this strategy is perhaps more reliable than recirculation systems, it is far from fail-safe. Hard (mineral-laden) water can eventually clog the valve, and poof!—the supposed freeze protection is gone.

Draindown valves, which were incorporated into direct-pump systems all over the United States, have been one of the worst hiccups in solar-thermal history. At a preset, low temperature, a controller activated the valves to divert water in the collectors to drain outside. However, like freeze valves, draindown valves were prone to failure due to corrosion, hard-water deposits, and clogging. Typically, the first winter freeze ruined the collector—when the valve failed, the collectors remained full of water and froze.

HARSH CLIMATE SYSTEMS

Drainback

These indirect forced-circulation systems are reliable, freeze tolerant, and fairly easy to install. The closed-loop drainback system requires perhaps the least amount of maintenance of any indirect, active system. The heat-transfer fluid is distilled water, which seldom has to be changed. When the system is not pumping, the solar collector is empty with the water having drained to the reservoir tank, usually located just above the solar storage tank. Higher-capacity reservoir tanks are typically required in large systems. The system relies on the collectors and piping being drained when freezing conditions are possible. Both are sloped toward the drainback tank so that when the pump turns off, the water in the collector loop passively drains back into the tank.

Since the pump must have enough power to push water from the drainback-tank fluid level to the top of the collectors—a distance that can be 20 or 30 feet—most installations require a high-head pump. Because of the head requirements and the limited choices in DC pumps, drainback systems are tougher to adapt to direct PV power. (Drainback systems are featured in *HP86* & *HP97*.)

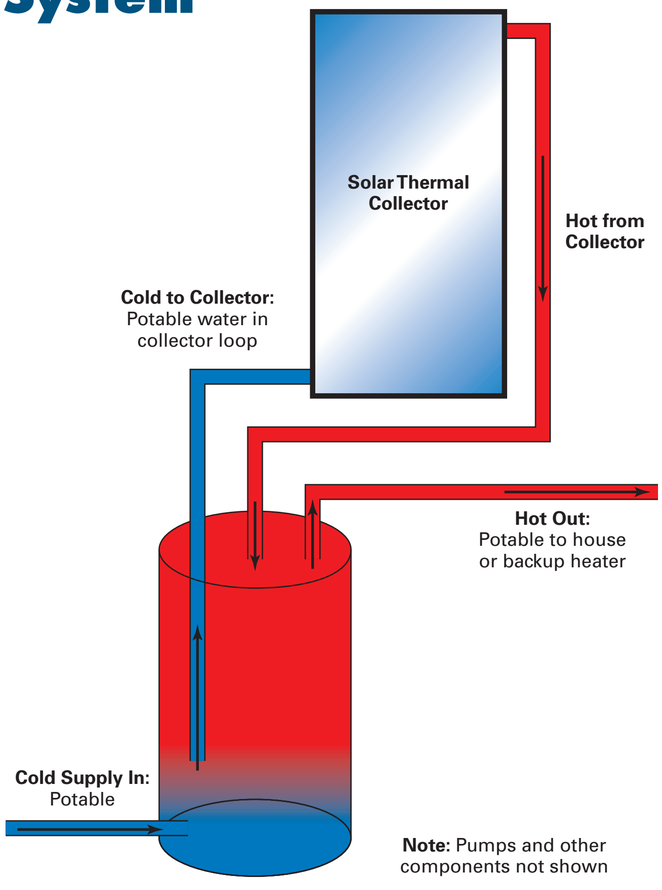
Antifreeze

This is the most complex indirect forced-circulation, closed-loop system—and therefore the most difficult to install. It also is the system with the best freeze protection, and as such, is popular in northern climates.

In this active, closed-loop system, incoming potable water is routed to the solar storage tank, but never into the collectors. A water–antifreeze mixture circulates from the collectors through a heat exchanger and then is pumped back through the collectors.

Antifreeze systems can overheat in the summer if there is too much collector surface area relative to tank storage volume. Overheating can be combated by using the "vacation mode" of newer differential controls, which will allow fluid to circulate through the system at night, cooling the fluid. PV-powered systems can incorporate a bypass valve around the check valve, which will allow the system to reverse thermosyphon at night to cool the antifreeze. (See Bob Inouye's article in *HP123* for details of a bypass valve. Antifreeze systems were covered in depth in *HP85* & *HP95*.) For a good overview of the five systems mentioned here, see "Solar Hot Water: Simplified" in *HP107*.

Basic Open-Loop System



Basic Closed-Loop System

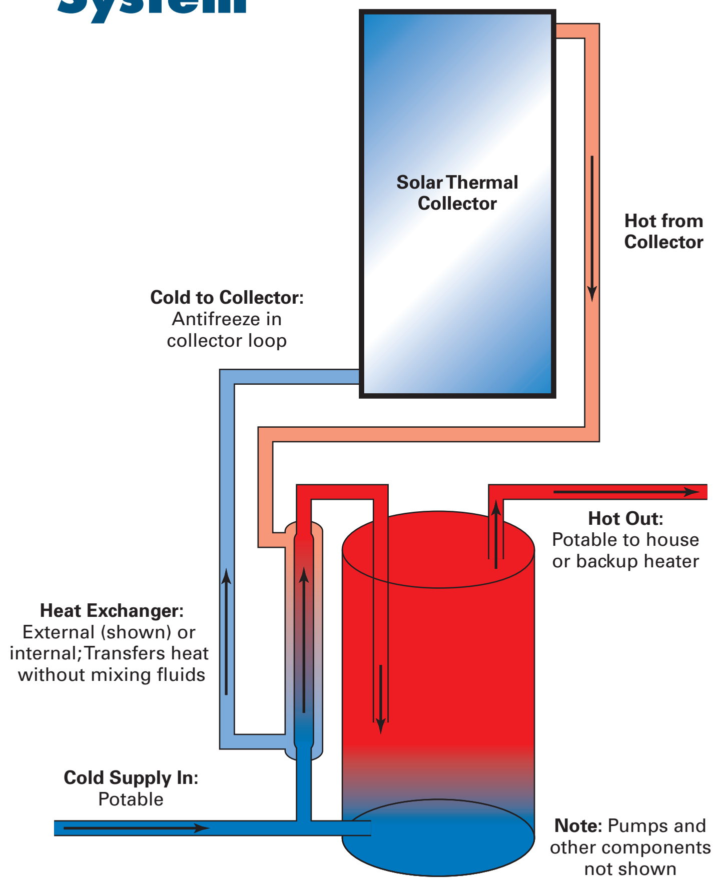


TABLE SPECS

Freeze-Tolerant Temperature—The temperature at which manufacturers estimate some part of the system is vulnerable to freezing. The SRCC says that "unless a system is installed in a nonfreezing climate, every system must have an automatic mechanism to at least partially protect it from freezing (i.e., automatic draining, antifreeze fluids, or thermal mass)."

Collector Size—The collector size for a given system is determined by the storage-tank volume and the amount of sunlight available at the installation site. The size of the collector is important: It must be large enough to do the job but not so big that it is a waste of money or causes overheating.

Storage Tank Size—System sizing is normally based on a one-day recovery time, which means that the storage tank should be large enough to satisfy the demands of a household for one day, at a minimum.

Annual KWH Saved—The SRCC catalog boils performance data down to savings estimates—given in annual estimated KWH—in several cities. We chose San Diego; Richmond, Virginia; and Seattle to represent sunny, partly cloudy, and cloudy climate conditions, respectively. The SRCC has modeled

MILD CLIMATE SYSTEMS

Manufacturer	Freeze Tolerant Temp. (°F)	Collector Size (Sq. Ft.)	Storage Tank Size (Gal.)	Annual KWH Saved		
				San Diego, CA	Richmond, VA	Seattle, WA
ACR Solar Intl.	30°	40.1	50	2,600	2,100	1,700
Energy Laboratories Inc.	22°	30.8	68	2,500	2,100	1,600
Heliodyne Inc.	27°	53.5	80	3,600	3,200	2,600
	27°	64.5	120	3,700	3,300	2,700
	27°	64.5	80	3,600	2,900	2,400
	27°	80.3	120	3,500	3,400	2,900
	27°	80.3	120	3,800	3,500	2,900
	27°	96.7	120	3,700	3,100	2,500
	27°	120.4	120	3,500	3,400	3,000
Integrated Solar LLC	20°	25.0	40	1,500	1,200	1,000
	20°	33.2	50	1,900	1,600	1,300
Rheem Water Heaters	19°	42.7	77	2,200	1,600	900
Solahart Industries	19°	85.4	113	3,300	2,500	1,600
	19°	85.4	113	3,300	2,500	1,600
	19°	64.0	77	3,000	2,600	2,100
	19°	85.4	113	3,200	2,800	2,200
	19°	85.4	113	3,200	2,800	2,300
	41°	64.0	90	3,500	2,700	2,200
	41°	64.0	114	3,600	2,700	2,200
Solene	20°	64.0	120	3,500	3,100	2,500
	20°	80.1	120	3,700	3,600	3,000
	20°	60.6	80	3,800	3,500	2,800
	20°	80.1	120	3,900	3,900	3,100
	20°	77.7	120	3,700	3,500	2,900
	20°	63.6	120	3,800	3,600	2,800
	20°	77.7	120	3,800	3,800	3,000
SunEarth Inc.	20°	39.7	64	2,400	2,000	1,700
	20°	49.8	84	2,600	2,200	1,800
	41°	40.9	80	3,000	2,500	2,000
	41°	40.9	80	3,100	2,600	2,000
	15°	73.9	116	3,000	2,600	2,100
	15°	81.7	116	3,300	2,800	2,300
	15°	65.7	80	3,000	2,500	2,000
Thermal Conversion Technology Inc.	10°	32.1	40	2,200	1,900	1,500
	10°	32.1	50	2,300	1,900	1,500

the systems data for many other cities in the United States and also provides listings on systems with gas backup, which are not included in our condensed table.

System Type—The catalog lists the systems by four types: integral collector storage (ICS, a.k.a. batch water heater); thermosyphon systems (open and closed loop); forced-circulation systems (direct pump, drainback, and antifreeze); and self-pumping systems. (Note: There are no self-pumping systems currently certified.)

Controller—Found only in forced-circulation (active) systems, controllers energize the system pump at the appropriate time. There are differential controllers, systems without controllers, and systems that use a PV module to automatically turn on the pump when the sun shines.

Fluid Used—Only two types of fluids, water (Type I fluid) and nontoxic propylene glycol antifreeze (Type II) mixed with water, are used in modern SHW systems.

Heat Exchanger—Transfers the energy collected by the collector-loop fluid to the domestic water used in the home. The type and size of heat exchanger can influence the system efficiency significantly. (For more info, see *HP92*.)

System Name	System Model	System Type	Collector Model	Aux. Tank Size (Gal.)	Fluid	Controller	Supply-Side Heat Exchanger
Skyline System 3	200132C502TE	Direct Forced Circulation	ACR Solar 20-01	50	Water	PV Panel Controller	None
Roof Integrated Thermosyphon	RITH 72 E	Direct Thermosyphon	Energy Lab. RITH-72	50	Water	None	None
Helio-Flo	HF 23366 G 80 AC S E	Direct Forced Circulation	Heliodyne - 336 000	None	Water	Differential Controller	None
	HF 2408 G 120 AC S E		Heliodyne - 408 000				
	HF 2408 G 80 AC S E		Heliodyne - 408 000				
	HF 2410 G 120 AC D E		Heliodyne - 410 000	50			
	HF 2410 G 120 AC S E		Heliodyne - 410 000	None			
	HF 3408 G 120 AC S E		Heliodyne - 408 000				
	HF 3410 G 120 AC D E		Heliodyne - 410 000	50			
CopperSun	CS340SV-E	Direct Integral Collector Storage	Sun Systems - CS 340	50	Water	None	None
	CS450-E		Sun Systems - CS 450	50			
Rheem Solaraide	RS80-42BP	Indirect Thermosyphon	Rheem - RS21-BP	None	Glycol	None	Mantle Heat Exchanger with a Single Wall
Solahart	444BCXII	Indirect Thermosyphon	Solahart - KF	None	Glycol	None	Mantle Heat Exchanger with a Single Wall
	444KF & 444KF Free Heat						
	ASE 303BCXII						
	ASE 444BCXII						
	ASE 444KF & ASE 444KF Free Heat						
Streamline Electric	340SL-3Bt	Direct Forced Circulation	Solahart - Bt		Water	Differential Controller	None
	430SL-3Bt						
Solene/Chromagen DC Open Loop	SLCR64DC-80	Direct Forced Circulation	Solene - SLCR-32	None	Water	Differential Controller	None
	SLCR80DC-120		Solene - SLCR-40				
Solene/Chromagen PV Open Loop	SLCR60PV-80		Solene - SLCR-30			PV Panel Controller	
	SLCR80PV-120		Solene - SLCR-40				
Solene/Corona DC Open Loop	SLCO80DC-120		Solene - SLCO-40			Differential Controller	
Solene/Corona PV Open Loop	SLCO64PV-120		Solene - SLCO-32			PV Panel Controller	
	SLCO80PV-120		Solene - SLCO-40				
CopperHeart	CP-60P	Direct Integral Collector Storage	SunEarth - CP-30	50	Water	None	None
	CP-80P		SunEarth - CP-40	50			
SunSaver	NF40P-80S	Direct Forced Circulation	SunEarth - EP-40	None		Differential Controller	
	NF40P-80T		SunEarth - EP-40				
SunSiphon	EPGX116-63-2	Indirect Thermosyphon	SunEarth - EP-24	50	Glycol	None	Mantle Heat Exchanger with a Single Wall
	EPGX116-80-2		SunEarth - EP-40	50			
	EPGX80-64-2		SunEarth - EP-32	50			
ProgressivTube	PT-40-CN	Direct Integral Collector Storage	TCT - PT-40-CN	50	Water	None	None
	PT-50-CN		TCT - PT-50-CN	50			

HARSH CLIMATE SYSTEMS

Manufacturer	Freeze Tolerant Temp. (°F)	Collector Size (Sq. Ft.)	Storage Tank Size (Gal.)	Annual KWH Saved		
				San Diego, CA	Richmond, VA	Seattle, WA
ACR Solar Intl.	-54°	40.1	80	2,300	1,900	1,600
	-54°	40.1	80	2,200	1,800	1,500
Alternate Energy Technologies	-20°	98.0	120	3,200	3,000	2,400
	-20°	63.8	120	3,300	3,100	2,500
	-20°	65.3	120	3,300	3,100	2,500
	-20°	79.6	120	3,400	3,300	2,700
	-20°	63.8	80	3,300	3,000	2,400
	-20°	65.3	80	3,300	3,000	2,400
	-20°	79.6	80	3,400	3,200	2,600
BFT Ltd.	-50°	33.1	65	1,500	1,300	1,100
	-50°	66.2	80	2,400	2,000	1,700
Bobcat & Sun Inc.	-60°	64.5	80	2,800	2,500	2,000
	-60°	64.5	80	3,000	2,700	2,200
	-60°	64.6	80	2,900	2,600	2,100
	-60°	65.7	80	2,900	2,600	2,100
Butler Sun Solutions	-54°	40.9	80	2,400	2,000	1,600
	-54°	40.9	80	2,500	2,000	1,500
	-54°	40.9	80	2,500	2,000	1,500
Enerworks Inc.	-50°	61.9	80	3,000	2,700	2,200
	-50°	92.8	120	2,700	2,500	2,200
Fafco Inc.	-20°	47.4	50	1,800	1,500	1,300
	-20°	47.4	80	1,900	1,600	1,300
	-20°	94.9	50	2,200	1,800	1,500
	-20°	94.9	80	2,300	2,000	1,600
Heat Transfer Products	-60°	43.6	80	NA	NA	NA
Heliodyne Inc.	-60°	53.5	80	3,200	2,800	2,200
	-60°	64.5	120	3,300	3,000	2,300
	-60°	80.3	120	3,500	3,200	2,600
	-60°	53.5	80	3,400	2,800	2,200
	-60°	80.3	120	3,600	3,200	2,600
	-60°	80.3	120	3,600	3,200	2,500
	-60°	96.7	120	3,700	3,400	2,700
Integrated Solar LLC	-60°	79.8	120	3,000	2,500	1,900
	-60°	39.9	65	2,200	1,800	1,400
	-60°	39.9	80	2,700	2,300	1,800
Morley Manufacturing	-60°	39.9	60	2,500	2,000	1,600
	-60°	40.1	60	2,500	2,000	1,600
	-60°	40.9	60	2,500	2,000	1,600
Mr. Sun Solar	-50°	39.8	80	2,900	2,500	2,000
	-50°	55.7	80	3,400	3,000	2,400

System Name	System Model	System Type	Collector Model	Aux. Tank Size (Gal.)	Fluid	Controller	Supply-Side Heat Exchanger
Skyline System 5	200152C80EX	Direct Forced Circulation	ACR Solar 20-01	None	Glycol	PV Panel Controller	Tank Wraparound Heat Exchanger with Double Wall and Positive Leak Detection
	200152C80EX2TE		ACR Solar 20-01	50			
EagleSun	DB-120-96	Indirect Forced Circulation - Drainback	MSC-32	None	Water	Differential Controller	Tank Wraparound Heat Exchanger with a Single Wall
EagleSun DX	DX-120-64		AE-32				Immersed Coil Heat Exchanger with a Single Wall
	DX-120-64		MSC-32				
	DX-120-80		AE-40				
	DX-80-64		AE-32				
	DX-80-64		MSC-32				
	DX-80-80		AE-40				
Solar Patriot	SP20-1-65G-PV-E	Indirect Forced Circulation - Antifreeze	BFT - SP-20	50	Glycol	PV Panel Controller	Immersed Coil Heat Exchanger with a Double Wall
	SP20-2-80G-PV-E		BFT - SP-20	50			
Sun-Pak	SP64CHE	Indirect Forced Circulation - Antifreeze	Heliodyne - 408 000	None	Glycol	Differential Controller	Tank Wraparound Heat Exchanger with Double Wall and Positive Leak Detection
	SP64CHE-1		Heliodyne - 408 000	None			
	SP64PHE-1		Radco - 408P-HP	None			
	SP64PHE-1		SunEarth - EP-32	None			
Solar Butler	BSS-PV1-80E2b	Indirect Forced Circulation - Antifreeze	SunEarth - SC-40	50	Glycol	PV Panel Controller	Immersed Coil Heat Exchanger with a Double Wall and Positive Leak Detection
	BSS-PV1-80Ea		SunEarth - SC-40	None			
	BSS-S1-80Ea		SunEarth - SC-40			Differential Controller	
Solar Water Heating Appliance	EWRA2-E80	Indirect Forced Circulation - Antifreeze	Enerworks - COL-4x8-TL-SG1-SD10US	50	Glycol	Differential Controller	Plate Heat Exchanger with a Single Wall
	EWRA3-E120		Enerworks - COL-4x8-TL-SG1-SD10US	50			
Polymer Drainback	VDB-48U-50E-50S	Indirect Forced Circulation - Drainback	Fafco - Revolution	50	Water	Differential Controller	Plate Heat Exchanger with a Single Wall
	VDB-48U-50E-80S			50			
	VDB-48UX2-50E-50S			50			
	VDB-48UX2-50E-80S			50			
SuperStor Contender Solar	SSC-80SE	Indirect Forced Circulation - Antifreeze	Apricus - AP-30	None	Glycol	Differential Controller	Immersed Coil Heat Exchanger with a Single Wall
Heliopak	16 DWCL HP 2 3366 G 80 ACS	Indirect Forced Circulation - Antifreeze	Heliodyne - 336 000	None	Glycol	Differential Controller	Shell-and-Tube Heat Exchanger with a Double Wall and Positive Leak Detection
	16 DWCL HP 2 408 G 120 ACS		Heliodyne - 408 000				
	16 DWCL HP 2 410 G 120 ACS		Heliodyne - 410 000				
Helio-Pak Helix SS PV	HP HX SS 2 3366 G PV 80 EE S		Heliodyne - 336 000			PV Panel Controller	
	HP HX SS 2 410 G PV 120 SE S		Heliodyne - 410 000				
	HP HX SS 3 3366 G PV 120 SE S		Heliodyne - 336 000				
	HP HX SS 3 408 G PV 120 SE S		Heliodyne - 408 000				
RadCo Drainback Heat Exchanger	R-DBHX-8-120S-80P	Indirect Forced Circulation - Drainback	Radco - 410P-HP	None	Water	Differential Controller	Immersed Coil Heat Exchanger with a Single Wall
	R-DBHX-8-65S-40P		Radco - 410P-HP				
	R-DBHX-8-80S-40C		Radco - 410C-HP				
High Sierra Drainback	HS60B/40	Indirect Forced Circulation - Drainback	Radco - 410P-HP	50	Water	Differential Controller	Shell-and-Tube Heat Exchanger with a Single Wall
	HS60B/40		Heliodyne - 410 000	50			
	HS60B/40		SunEarth - EC-40	50			
Sol-Reliant	SR 40/80 E PVDB	Indirect Forced Circulation - Antifreeze	AE-40	50	Glycol	PV Panel Controller	Tank Wraparound Heat Exchanger with a Double Wall and Positive Leak Detection
	SR 56/80 E PVDB		AE-56	50			

HARSH CLIMATE SYSTEMS

Manufacturer	Freeze Tolerant Temp. (°F)	Collector Size (Sq. Ft.)	Storage Tank Size (Gal.)	Annual KWH Saved		
				San Diego, CA	Richmond, VA	Seattle, WA
Schuco USA L.P.	-40°	58.1	80	3,000	2,700	2,200
	-40°	87.1	120	3,300	3,100	2,500
	-40°	49.7	80	2,900	2,500	2,100
	-40°	74.6	120	3,300	3,000	2,400
Solar Energy Inc.	-20°	115.7	120	3,400	3,100	2,500
	-20°	119.4	120	3,400	3,100	2,500
	-20°	95.7	120	3,300	3,000	2,300
	-20°	98.5	120	3,300	3,000	2,300
	-20°	65.6	80	3,100	2,700	2,200
	-20°	77.1	80	3,200	2,900	2,300
	-20°	79.6	80	3,200	2,900	2,300
Solarhot	-10°	64.0	80	3,400	3,200	2,600
	-10°	64.5	80	3,400	3,200	2,600
Solene	-10°	60.6	80	3,200	2,900	2,300
	-10°	64.0	80	3,300	2,900	2,400
	-10°	63.6	80	3,200	2,800	2,300
	-10°	77.7	80	3,400	3,000	2,500
	-10°	77.7	80	3,200	2,900	2,300
	-10°	63.6	80	3,200	2,800	2,300
	-10°	77.7	80	3,400	3,000	2,500
Stitt Energy Systems Inc.	-40°	79.6	120	3,100	2,600	2,100
	-40°	39.8	80	2,300	1,900	1,600
SunEarth Inc.	-50°	65.7	80	3,200	2,900	2,400
	-60°	65.7	80	3,500	3,200	2,600
	-60°	65.7	80	3,500	3,000	2,400
	-60°	65.7	80	3,400	3,100	2,500
	-60°	81.7	120	3,600	3,400	2,800
	-60°	81.7	120	3,400	3,300	2,700
	-60°	81.7	120	3,700	3,300	2,600
	-60°	81.7	120	3,600	3,300	2,700
Synergy Solar	-50°	39.6	80	2,700	2,200	1,800
	-50°	53.4	80	3,100	2,600	2,100
	-50°	53.4	80	3,000	2,600	2,100
	-50°	59.4	80	3,000	2,700	2,200
	-50°	53.4	80	2,700	2,300	1,900
Thermomax Industries Ltd	-60°	65.9	80	3,200	2,900	2,300
	-60°	82.2	120	3,400	3,100	2,500
	-60°	98.6	120	3,500	3,400	2,700
	-50°	92.1	120	3,400	3,100	2,500
	-50°	92.1	80	3,400	3,100	2,500
	-50°	107.4	120	3,500	3,300	2,600
Trendsetter Industries	-20°	81.7	120	2,800	2,500	2,100

System Name	System Model	System Type	Collector Model	Aux. Tank Size (Gal.)	Fluid	Controller	Supply-Side Heat Exchanger
Premium Package	Premium II-80E	Indirect Forced Circulation - Antifreeze	Schuco - V, H, LA	None	Glycol	Differential Controller	Tank Wraparound Heat Exchanger with a Double Wall and Positive Leak Detection
	Premium III-120E		Schuco - V, H, LA				
Slimline Package	Slimline II-80E		Schuco - V, LA				
	Slimline III-120E		Schuco - V, LA				
Duro-Drainback Solar Water Heating System	D2B-12009120	Indirect Forced Circulation - Drainback	Solar Energy - SE-40	None	Water	Differential Controller	Shell-and-Tube Heat Exchanger
	D2B-12009120		Alternate Energy Tech. - AE-40				
	D2B-12009-96		Alternate Energy Tech. - AE-32				
	D2B-12009-96		SunEarth - EP-32				
	D2B-8009-63		Solar Energy - SE-21				Tank Wraparound Heat Exchanger
	D2B-8009-80		Solar Energy - SE-40				
	D2B-8009-80		Alternate Energy Tech. - AE-40				
Solvelox DB	S-SV-DB100	Indirect Forced Circulation - Drainback	Solene - SLCR-32	None	Water	Differential Controller	Plate Heat Exchanger with a Single Wall
	S-SV-DB100		Heliodyne - 408 000				
Solene/Chromagen DC Closed Loop	SLCR60DC-80HE	Indirect Forced Circulation - Antifreeze	Solene - SLCR-30	None	Glycol	Differential Controller	Tank Wraparound Heat Exchanger with a Double Wall and Positive Leak Detection
	SLCR64DC-80HE		Solene - SLCR-32				
Solene/Corona DC Closed Loop	SLCO64DC-80HE	Indirect Forced Circulation - Drainback	Solene - SLCO-32		Water		
	SLCO80DC-80HE		Solene - SLCO-40				
	SLCO80DC-80HE-XE		Solene - SLCO-40	50			
Solene/Corona Drainback	SLCO64DC-80DB		Solene - SLCO-32	None			
	SLCO80DC-80DB		Solene - SLCO-40				
Sup.plen.ergy Solar Water Heater	SESI-120-80	Indirect Forced Circulation - Antifreeze	Alternate Energy Tech. - AE-40	None	Glycol	PV Panel Controller	Tank Wraparound Heat Exchanger with a Double Wall
	SESI-80-40		Alternate Energy Tech. - AE-40				
Cascade	ECRD-64-80	Indirect Forced Circulation - Drainback	SunEarth - EC-32	None	Water	Differential Controller	Tank Wraparound Heat Exchanger with a Double Wall and Positive Leak Detection
Solaray	TE64C-80-1	Indirect Forced Circulation - Antifreeze	SunEarth - EC-32		Glycol		
	TE64C-80-PV		SunEarth - EC-32			PV Panel Controller	
	TE64P-80-1		SunEarth - EP-32			Differential Controller	
	TE80C-120-1		SunEarth - EC-40				
	TE80C-120-2		SunEarth - EC-40	50			
	TE80C-120-PV		SunEarth - EC-40	None		PV Panel Controller	
	TE80P-120-1		SunEarth - EP-40			Differential Controller	
Drainback Stainless HX	40-1T	Indirect Forced Circulation - Drainback	Synergy - TC-19.78	None	Water	Differential Controller	Plate Heat Exchanger with a Single Wall
	53-1T		Synergy - TC-26.52				
	53-2T		Synergy - TC-26.52	50			
	60-2T		Synergy - TC-19.78	50			
	S53-2T		Synergy - S26.68	50			
Thermomax Mazdon	Mazdon 40-R80	Indirect Forced Circulation - Antifreeze	Thermo Tech. - TMA-600-20	None	Glycol	Differential Controller	Tank Wraparound Heat Exchanger with a Double Wall and Positive Leak Detection
	Mazdon 50-R120		Thermo Tech. - TMA-600-50				
	Mazdon 60-R120		Thermo Tech. - TMA-600-30				
Thermomax Solamax	Solamax 60R-R120		Thermo Tech. - AST30				
	Solamax 60R-R80		Thermo Tech. - AST30				
	Solamax 70R-R120		Thermo Tech. - AST70				
Six Rivers Solar	SRS-100-2-40-PC-E	Indirect Forced Circulation - Drainback	SunEarth - SP-40	50	Water	Differential Controller	None

Certification for Tax Credit Eligibility?

Unless federal tax credits for SHW systems are extended, this may be the last year you can take advantage of Uncle Sam by installing a solar hot water system. Under the existing federal tax credit law, owners of new SHW installations are eligible for a tax credit of up to $2,000. But when it comes to what kind of certification is required to receive a break from the Feds, the waters are muddy. The law states that "the property" of residential solar water heaters must be certified by the SRCC, but it's unclear whether this refers to the collector or the whole system.

While we aren't aware of anyone being denied the federal tax credit from basing their claim on the OG-100 standard, some states and utility districts are requiring OG-300 ratings to be eligible for their incentives, including Arizona; California—Sacramento Municipal Utility District and City of Thousand Oaks; Colorado; Illinois; Nevada—Public Utilities Commission; and Oregon—Eugene Water and Electric Board and the City of Ashland.

System Selection Considerations

Once you've classified your climate, you can determine what system is right for your site. What's best? If you live in a freezing climate—or in a milder climate but just want to hedge your bets, use a drainback or antifreeze closed-loop system. If it doesn't freeze, or freezes are rare and mild, one of three "mild-climate" systems can fit your needs. Passive or active, PV or AC powered, these choices are up to you. Systems with quality components should have decades of good performance.

Access

Contributing editor **Chuck Marken** (chuck.marken@homepower.com) is a New Mexico-licensed plumber, electrician, and heating and air conditioning contractor. He has been installing and servicing solar thermal systems since 1979. Chuck is a part-time instructor for Solar Energy International and the University of New Mexico.

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