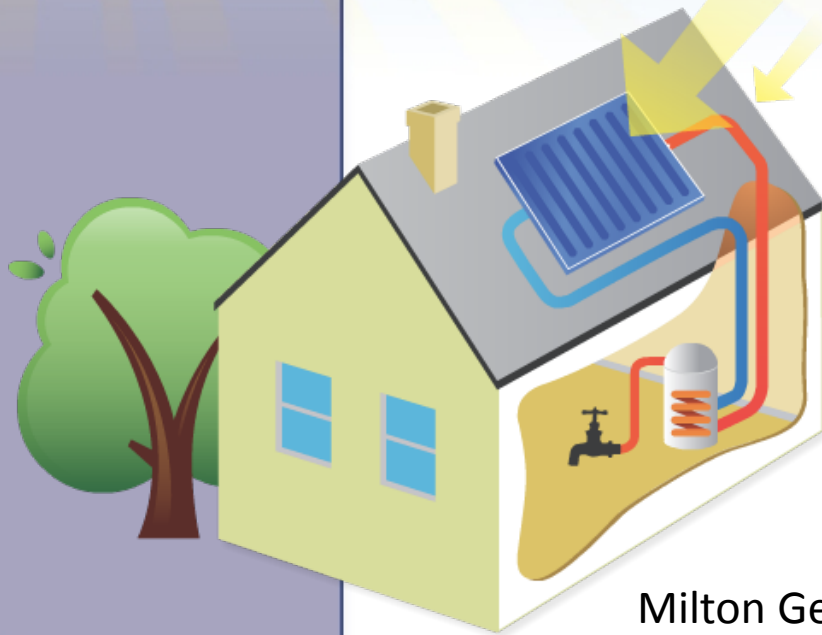
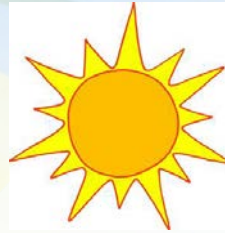


E³A

Solar Hot Water for Home, Farm, & Ranch



Using The Sun To Heat Water

Milton Geiger, UW Extension

April 14, 2014

Credit Susan Bilo, Montana State University

E3A Folder & Factsheets: Solar Hot Water for Home, Farm & Ranch



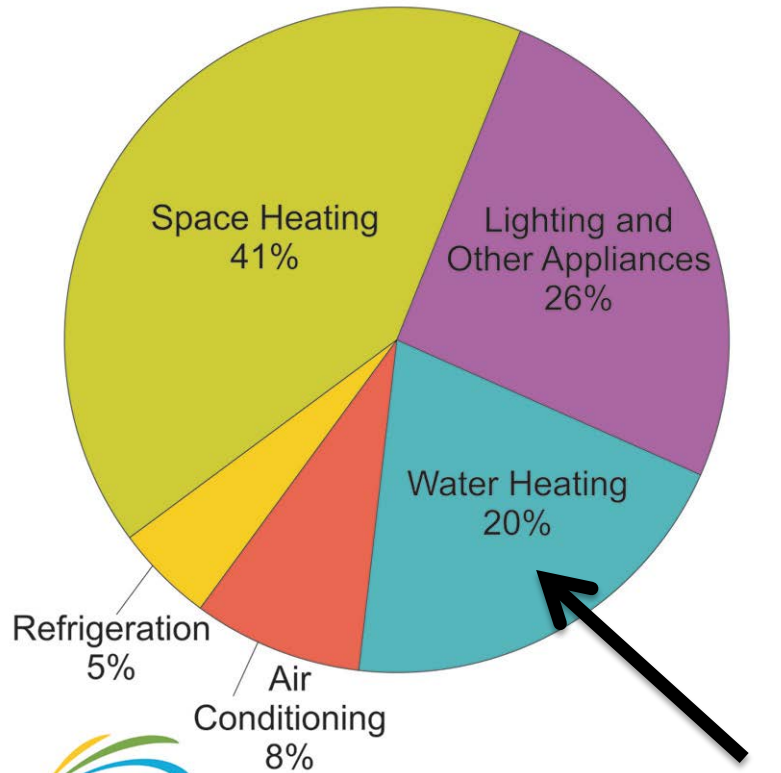
Solar Thermal – What for

- Solar hot water
 - Heat domestic or commercial hot water
- Solar heating
 - Liquid
 - Larger hot water system
 - Air
 - Dedicated heating system

Don't forget about passive solar!

Home Water Heating

How Energy is Used in Homes (2005)



Source: U.S. Energy Information Administration,
Residential Energy Consumption Survey 2005.



Agriculture Water Heating



Credit: Amaltheia
Dairy,
Belgrade, MT



For some dairy farms, water heating can account for 25% of the total energy used. Heated water is mainly used for cleaning milking systems.

Solar Thermal – Not your father's solar panel...



How We Heat Water



Black Water Tanks & White Fuel Tanks

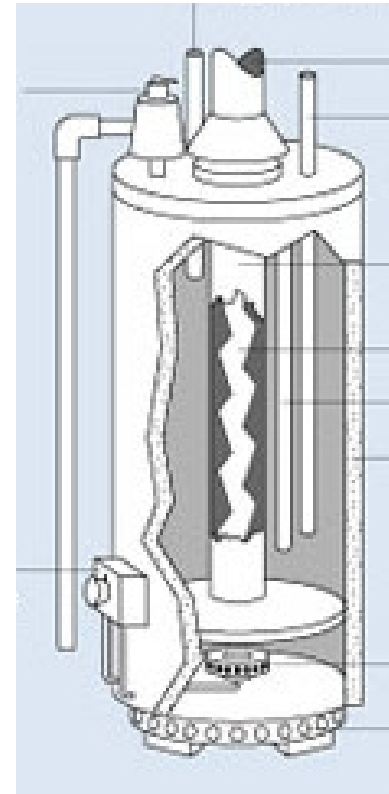


Credit: <http://www.nwauctionservice.com/March09AuclImages.htm>

How We Heat Water (*without Spot's help*)

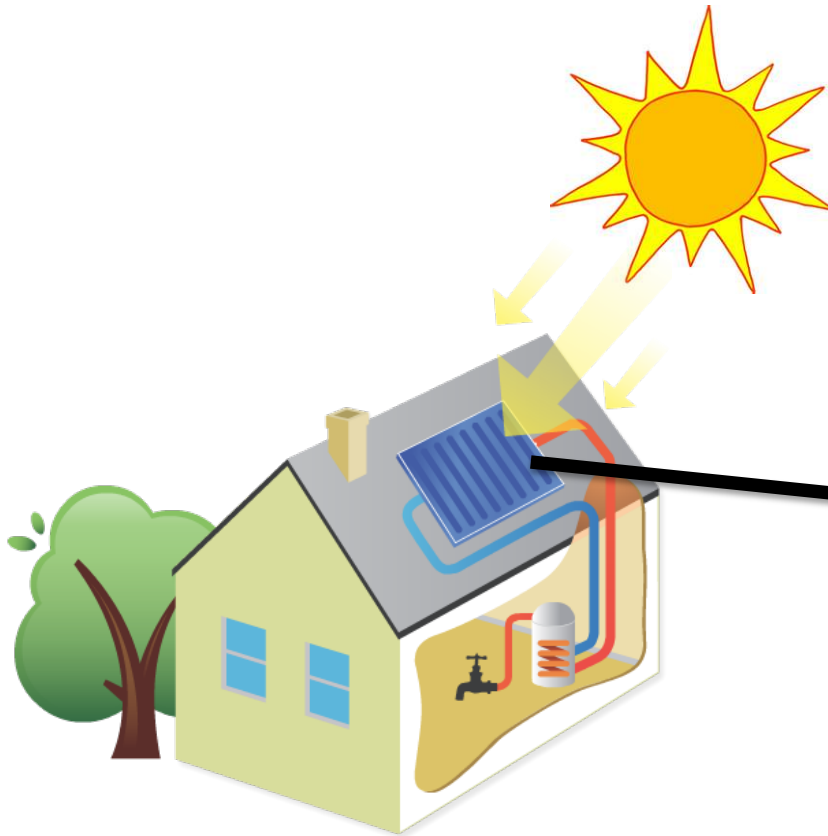


We typically heat water using natural gas or electricity.



Inside a natural gas-fueled water heater.

Heating Water With the Sun's Energy



Credit: <http://www.solarplusuk.com/solar-thermal-hot-water>

Three, roof-top solar hot water collectors.

Does Your Roof Have Enough Space?



Wall-mounted solar hot water collectors in Bozeman, Montana.

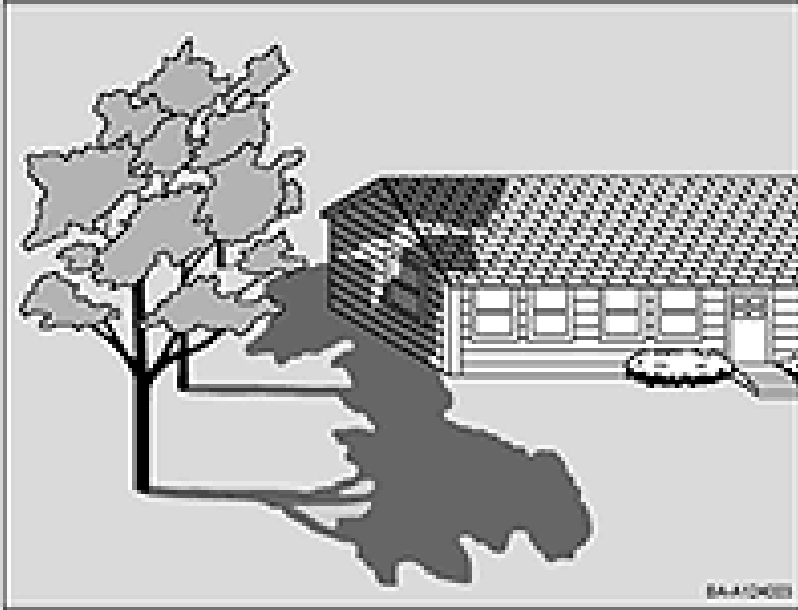
Credit: Liquid Solar Systems



Ground-mounted solar hot water collectors.

Credit: HotBoxSolar.com

Got Shade?



Credit: www.energyefficientheatingandcooling.com



Credit: www.solarworks.co.uk

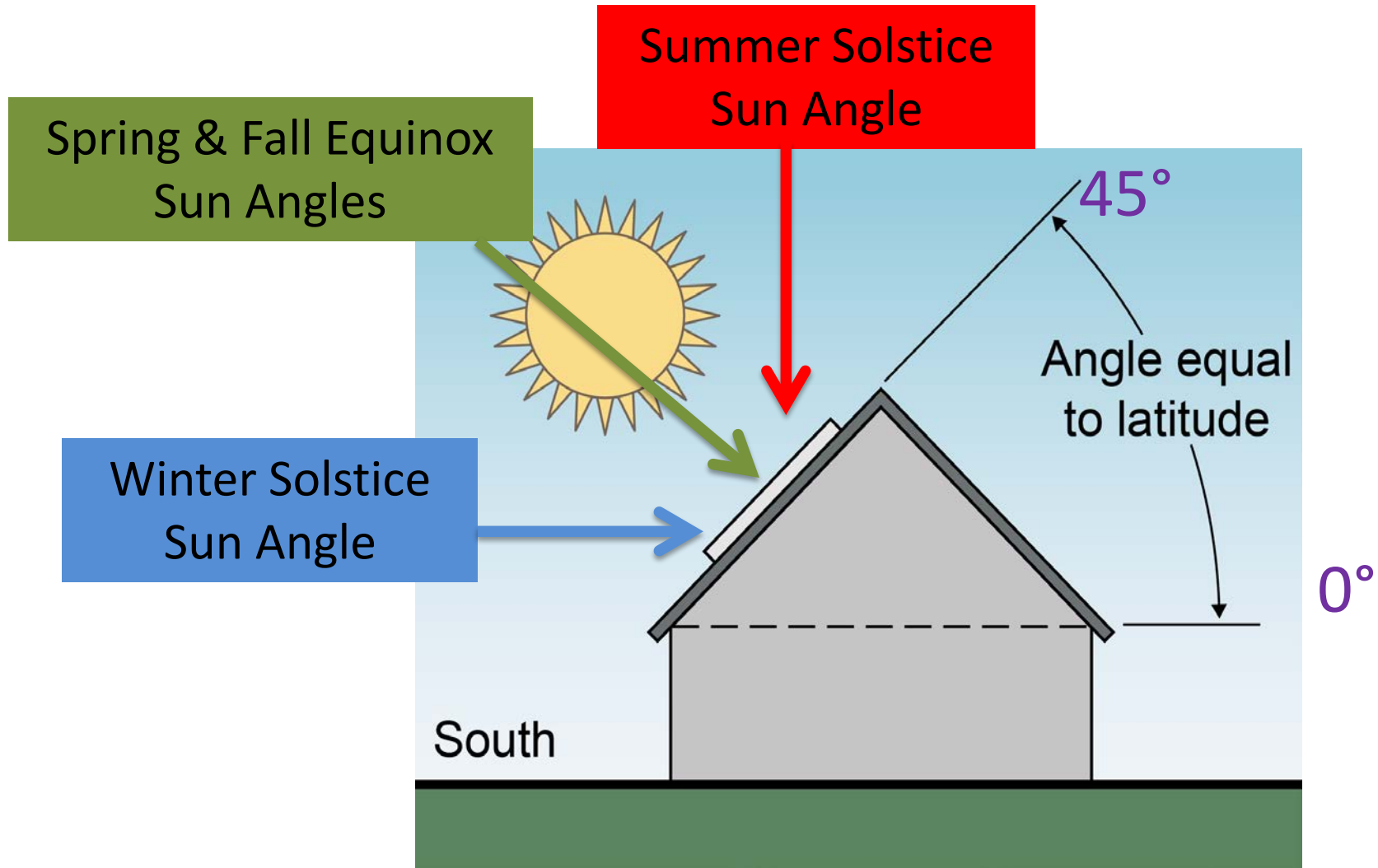


Solar PathFinder



Solmetric's SunEye

What's Your Angle?



Credit: DOE/NREL

What does a Volkswagen Beetle and a Solar Hot Water Collector have in common?

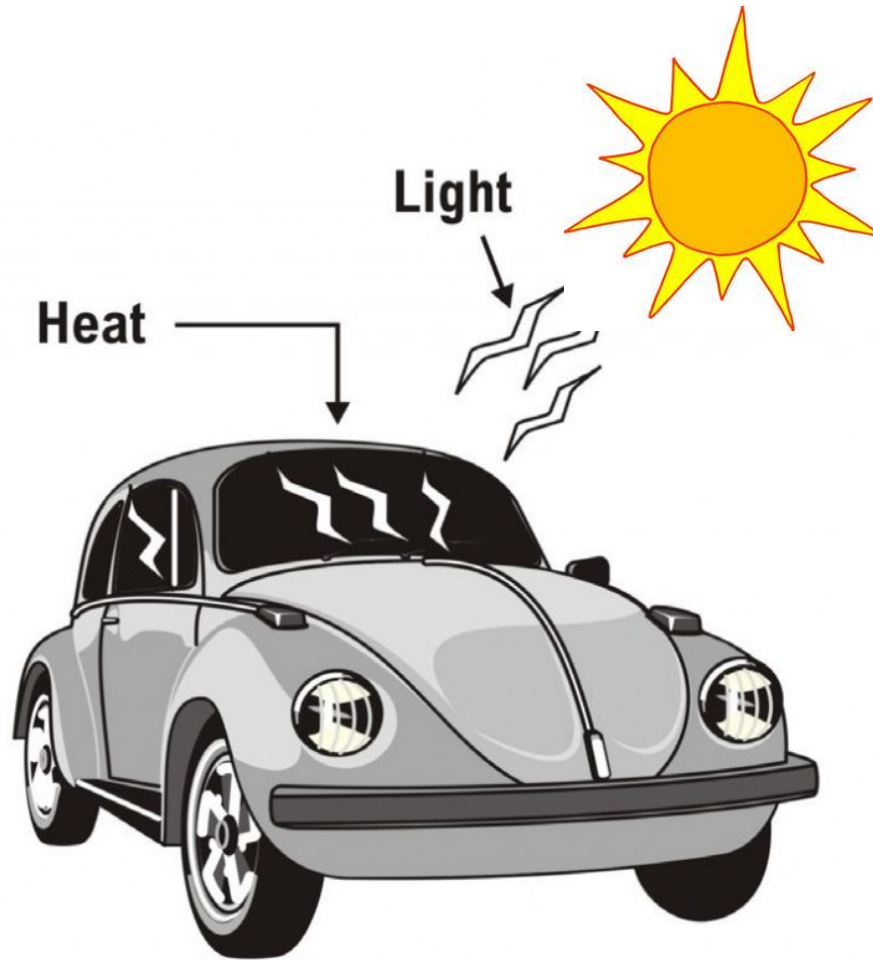


Credit: http://www.carsbase.com/photo/photo_full.php?id=17901

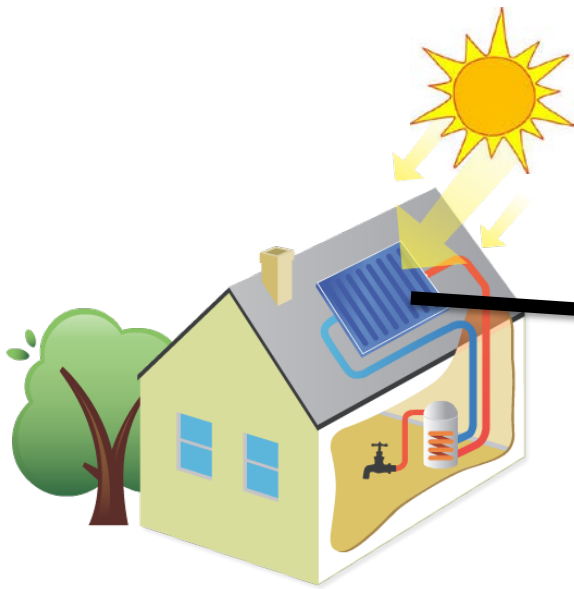


Credit: <http://switchsource.co.uk/solarthermal.html>

A Solar Collector!



How Does It Work?



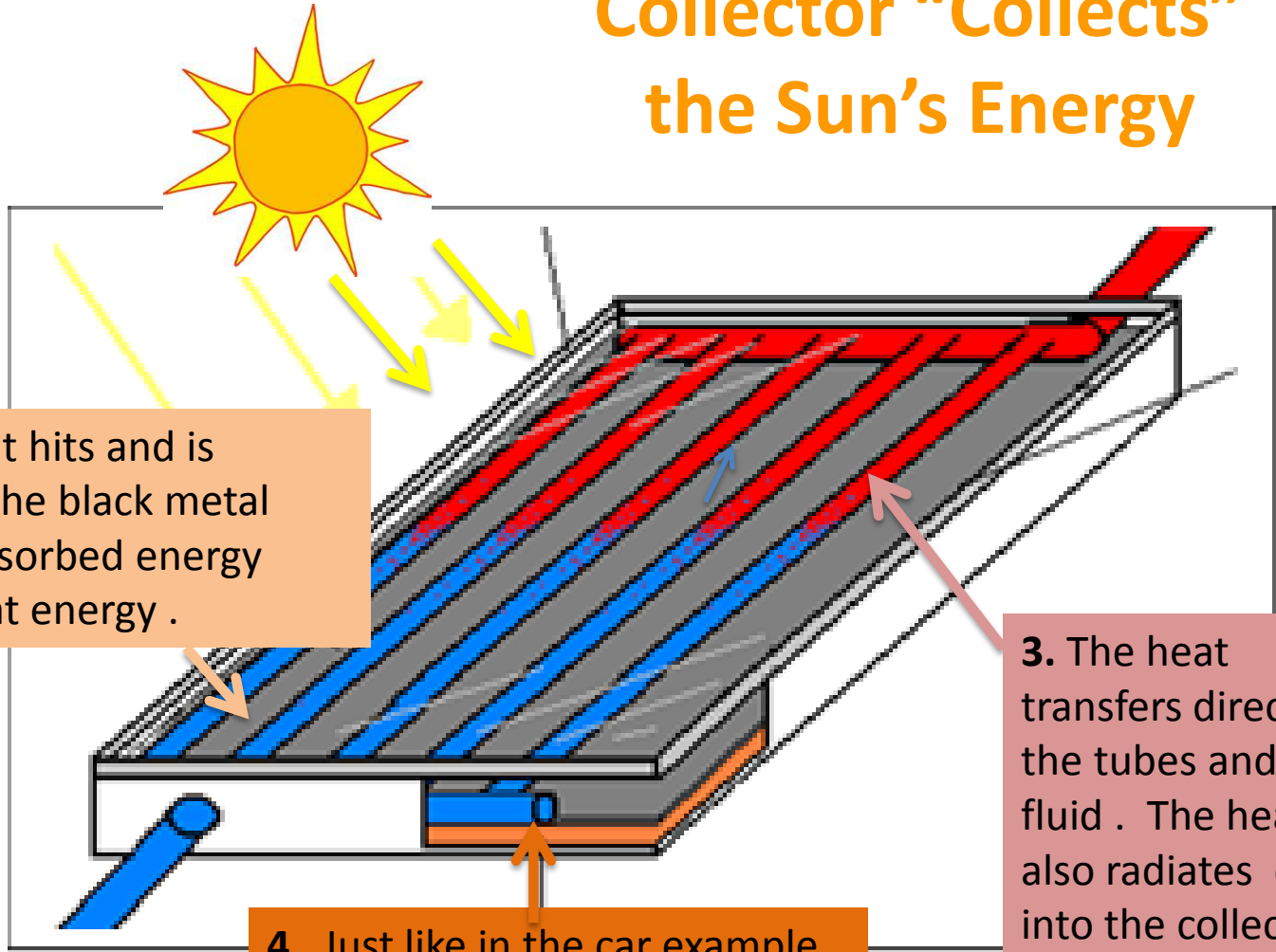
1. Sunlight enters the collector through the glass covering.

How A Solar Hot Water Collector “Collects” the Sun’s Energy

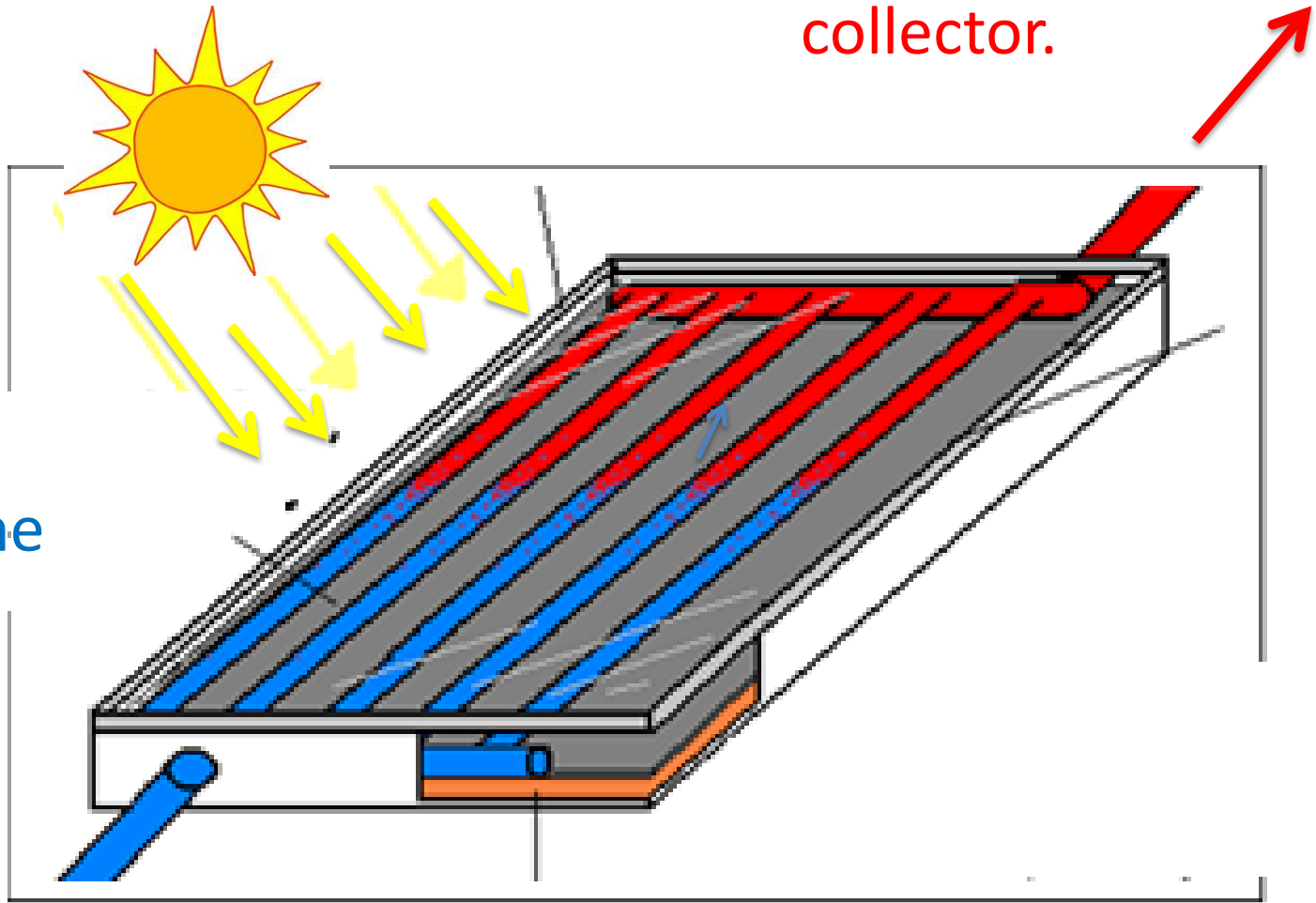
2. The sunlight hits and is absorbed by the black metal plate. The absorbed energy turns into heat energy .

3. The heat transfers directly to the tubes and their fluid . The heat also radiates out into the collector air space.

4. Just like in the car example, the glass traps the heated air. The collector’s insulation helps retain the heat.



Heated fluid
exiting the
collector.



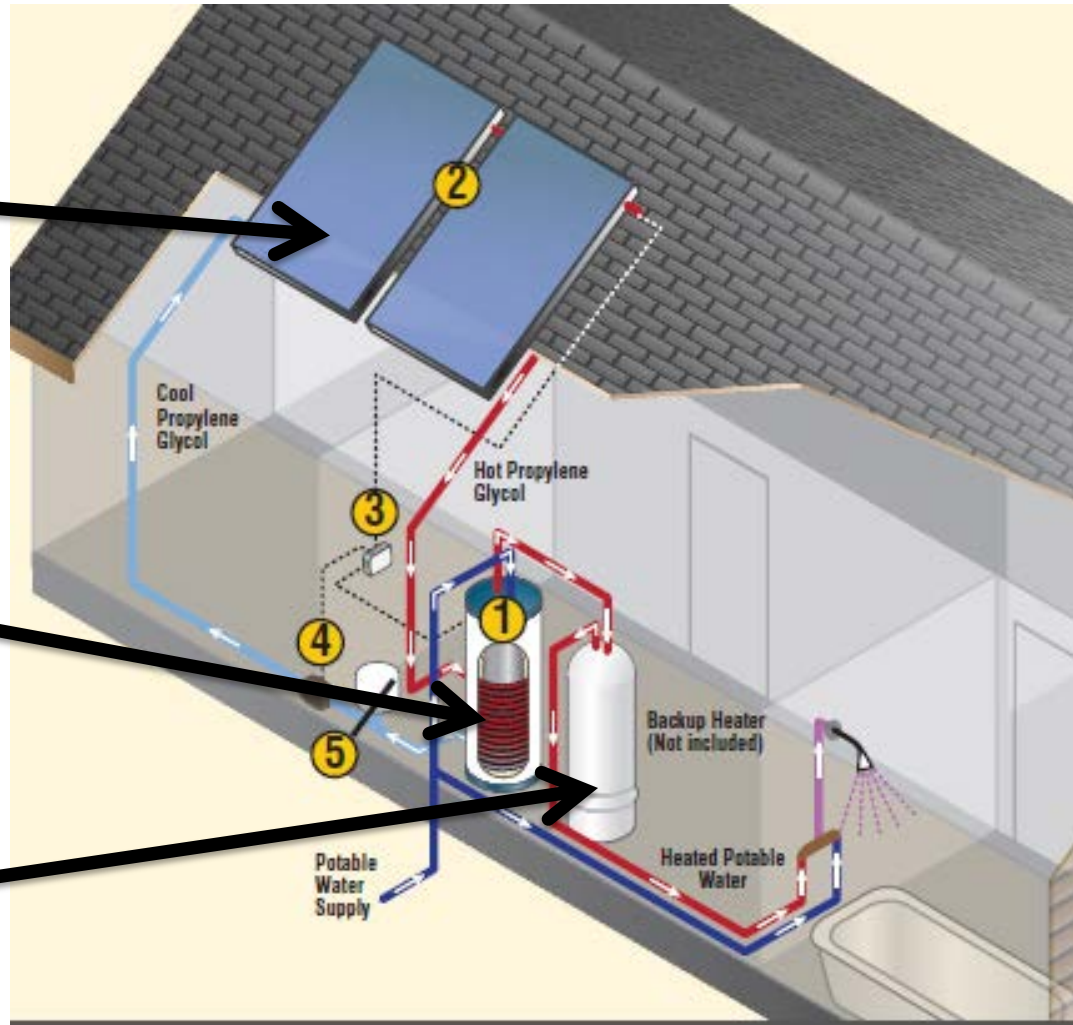
Cold fluid
entering the
collector.

Solar Hot Water System Components

1. Collectors

2. Solar Water Tank

3. Back-Up



Credit: Rheem Manufacturing Company

1. The Collectors



Flat-plate
solar hot water collectors



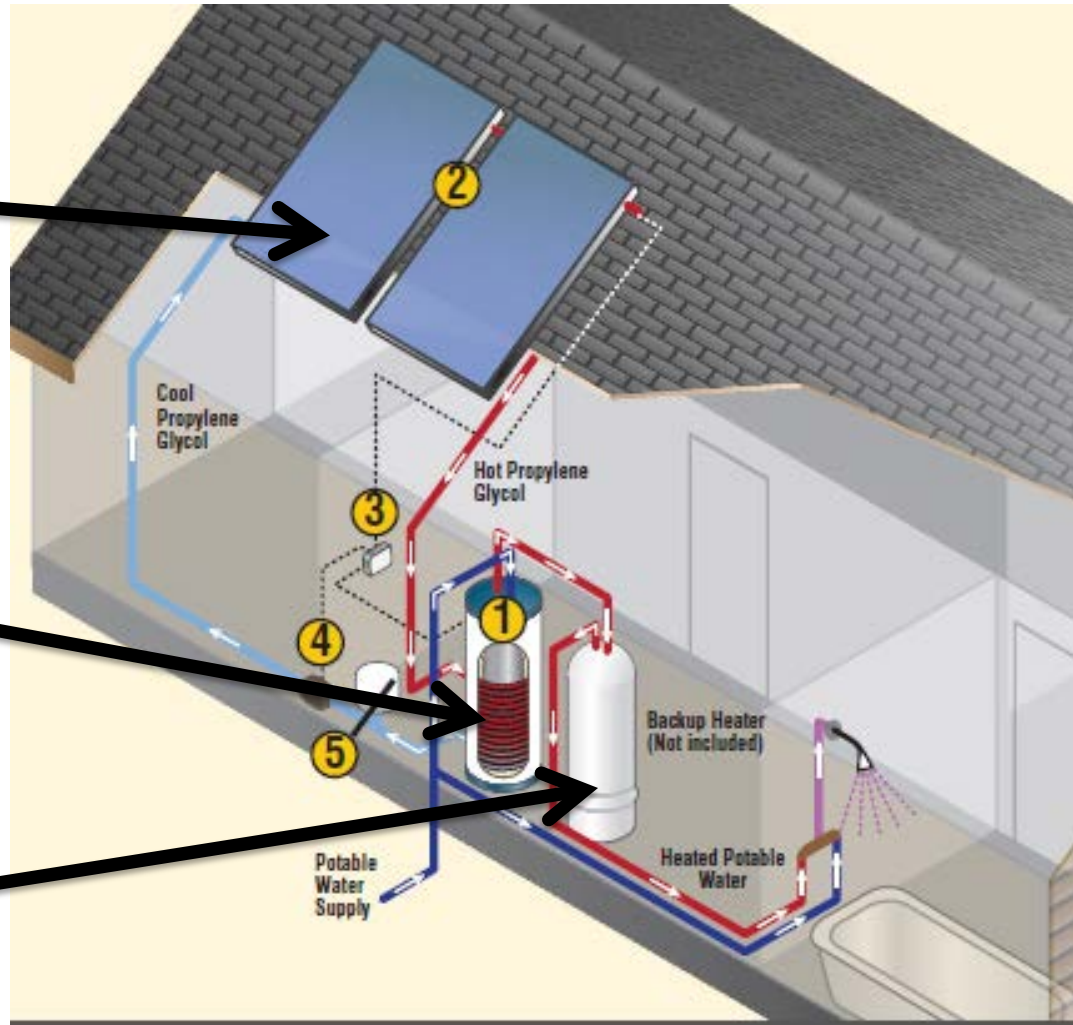
Evacuated tube
solar hot water collectors

Solar Hot Water System Components

1. Collectors

2. Solar Water
Tank

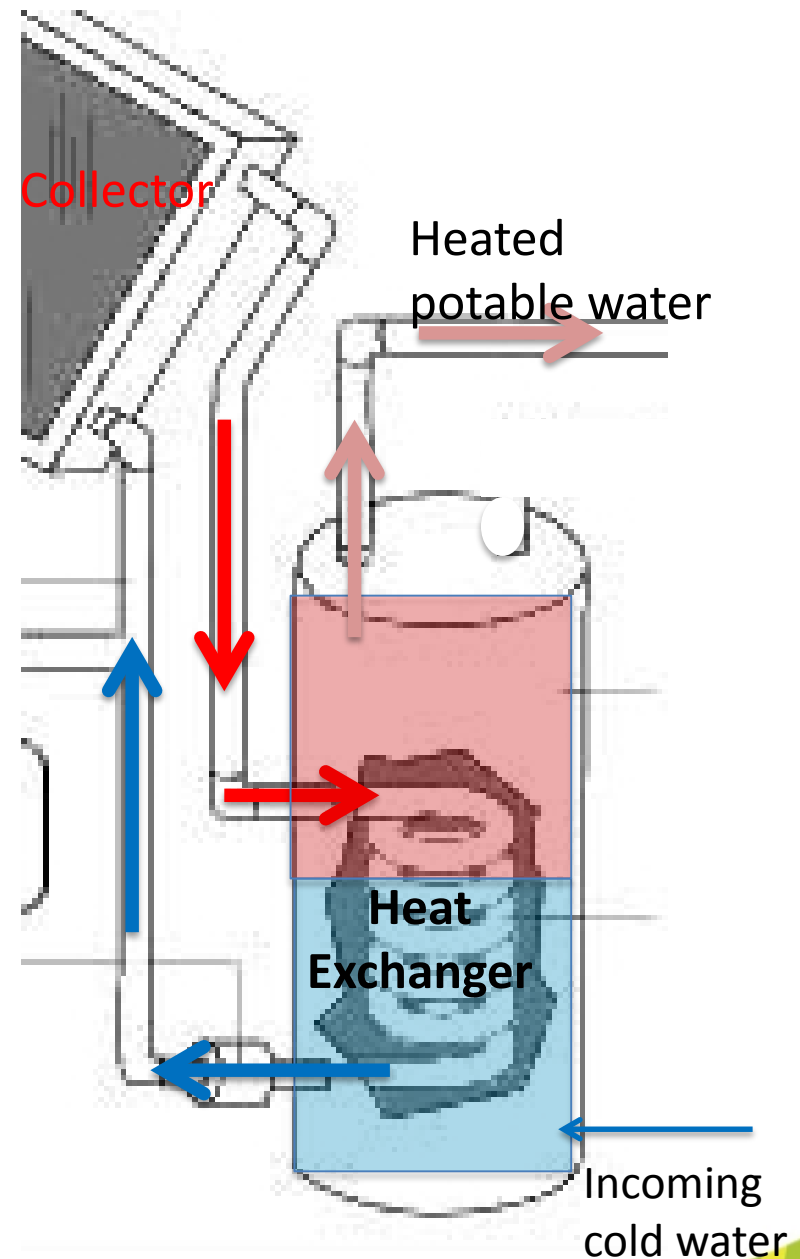
3. Back-Up



Credit: Rheem Manufacturing Company

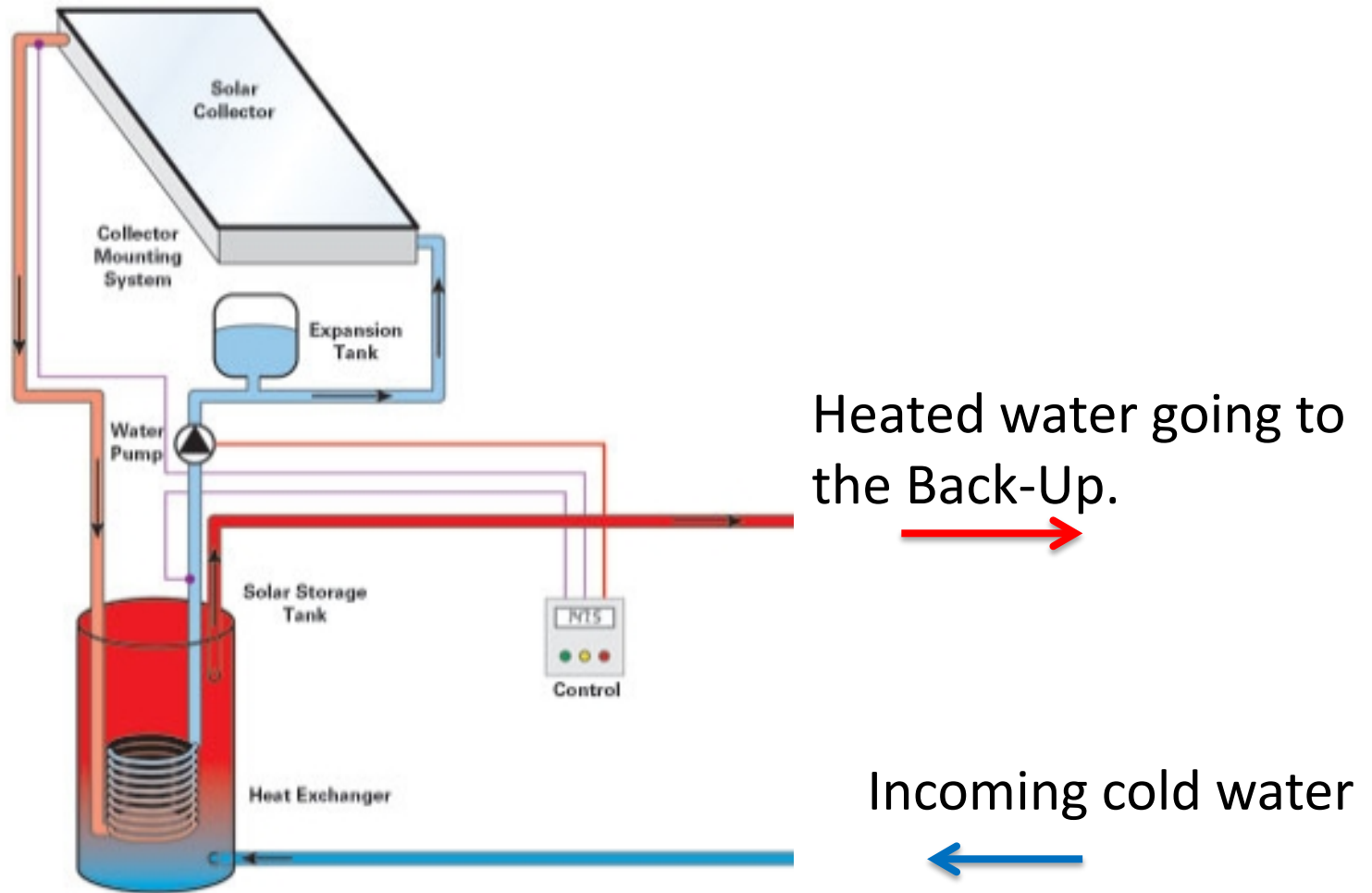
2. Solar Water Tank

- The heat transfer takes place through a heat exchanger.
- The collector-heated fluid never makes contact with the potable water in a “closed loop” system.



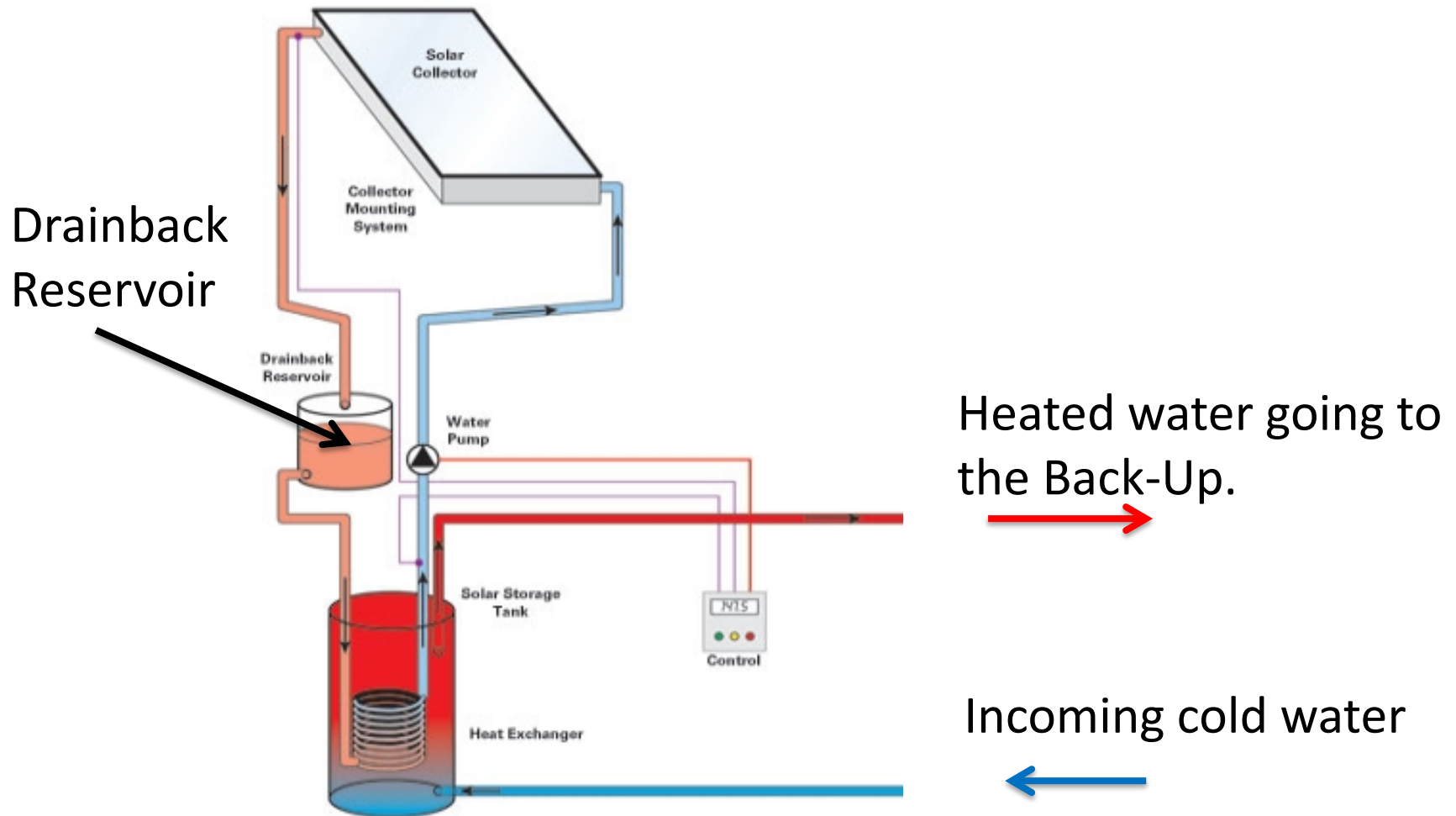
Credit: DOE/NREL

Antifreeze System



Credit: <http://homepower.com/basics/hotwater/>

Drainback System



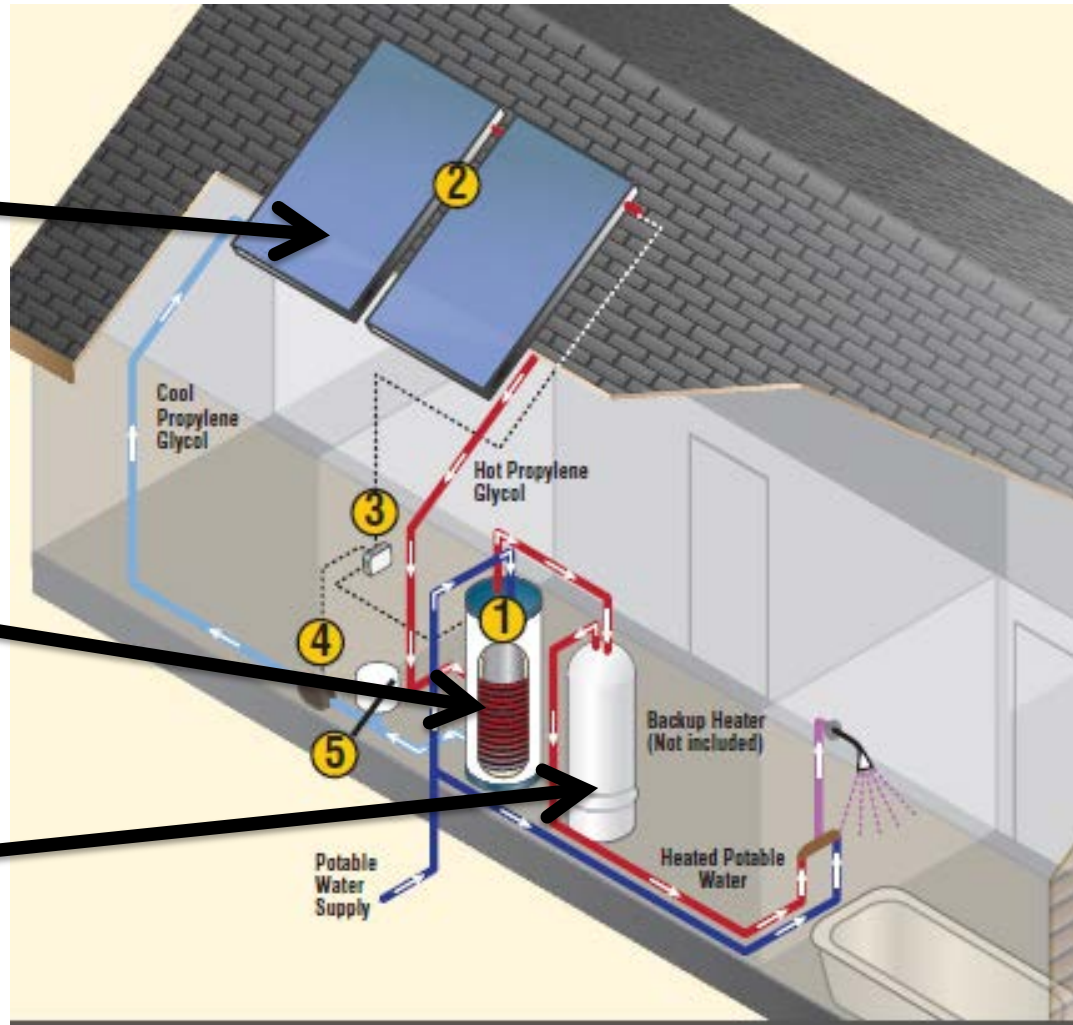
Credit: <http://homepower.com/basics/hotwater/>

Solar Hot Water System Components

1. Collectors

2. Solar Water Tank

3. Back-Up



Credit: Rheem Manufacturing Company

3. Back-Up

Water Heater Options

- An existing (or new) traditional water heater.
- One tank can serve as both the solar water tank and back-up.
- A tankless (on-demand) water heater.

Why is a Back-Up Needed...it's Alaska!

- If the solar hot water system is designed to produce only a portion of the hot water used.
- If the solar hot water system does not heat water to the desired temperature.

Collector Heating Temperatures (Credit: homepower)		
	Summer	Winter
Clear	140-180°F	120-150°F
Cloudy	70-90°F	50-60°F

- If there is a higher-than-normal demand.

Cost\$

- Cost depends on a variety of factors including: how much sun you get, system size, which collector and system type is used, back-up fuel costs, etc.
- Residential solar hot water systems range from \$4,000 to \$10,000.
- Simple payback times ranges from 4 to 8 years.
- If replacing an electric water heater, a solar hot water system can reduce water heating bills by up to 70%.
- A water-efficient home/building can purchase a smaller, less expensive solar hot water system.

Solar Thermal – Let's build one...

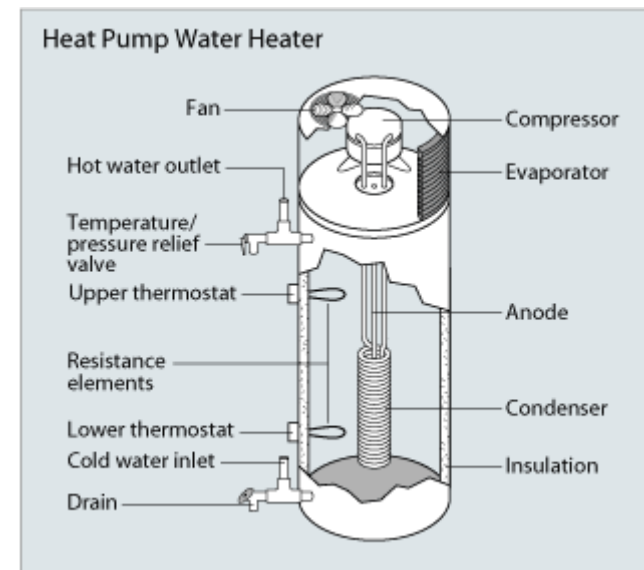


Alternatives to solar thermal

- Efficiency first!
 - On demand is an option
- Air-source heat pump water heater

Air source heat pump water heater

- What –Heats domestic hot water
- Where –Pulls heat surrounding space
- Why – 200-300% “efficient”
- How much – ~\$1000-2000



Alternatives economics

- 3-4 person home = 50 gallon unit
- 1830 kWh per year (for GE Geospring)
- Require 1.25 kW of solar in Big Horn Basin
 - Economies of scale with larger system but ~\$6000 of PV
- Total cost ~\$8000 to heat hot water
- Durable system with no “unusable energy”
 - Net metered with 25 year warranty on PV

Similar cost structure to solar thermal...

Installation



The Components

SRCC = Solar Rating and Certification Corporation
SRCC tests performance and certifies almost every solar hot water heater on the market.

The Installer

Make sure the installer you hire is qualified.
Ask about certifications, trainings, or licenses.



What's Next?

E3A Folder &
Factsheets:
Solar Hot Water
for Home,
Farm & Ranch



Using the Sun to Heat Air



Flat-Plate Air Collector on a barn roof.

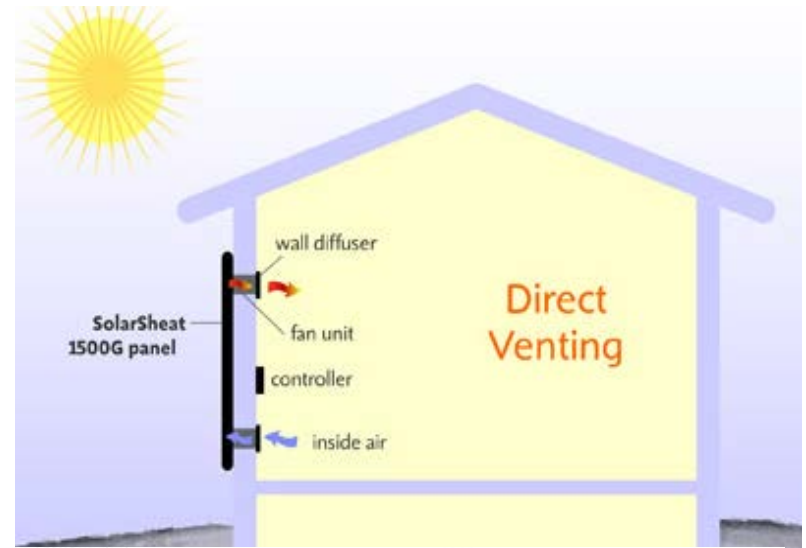
Credit: Conserval Systems, Inc.



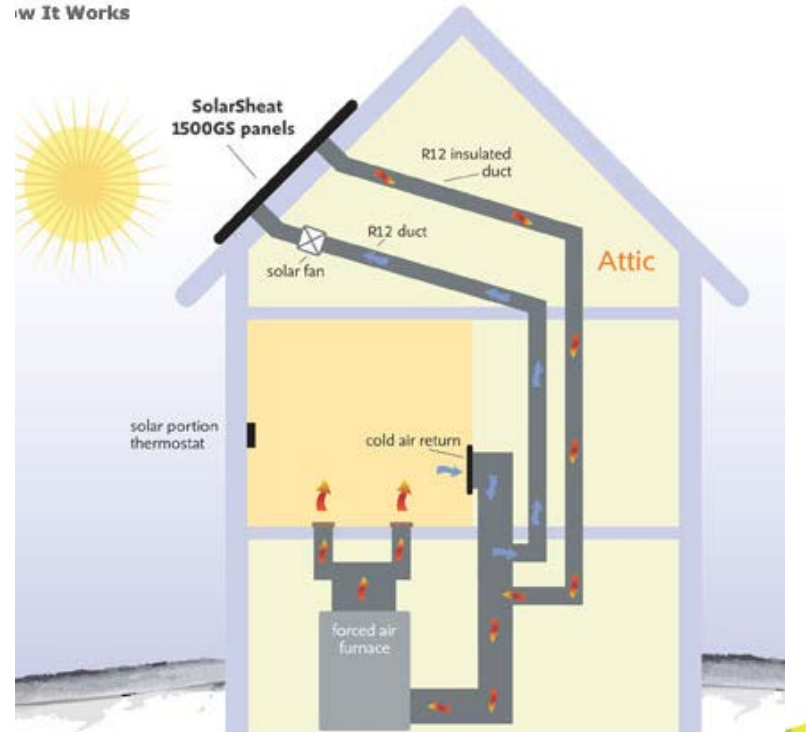
Transpired Air Collector on a pig nursery barn.

Credit: Conserval Systems, Inc.

Flat Plate Solar Air Collectors



How It Works



Flat-plate solar air collector.

Credit: Your Solar Home & SolarSheat

Transpired Air Collectors

