Solar Energy in Heating and Cooling Devices

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ECE 4803

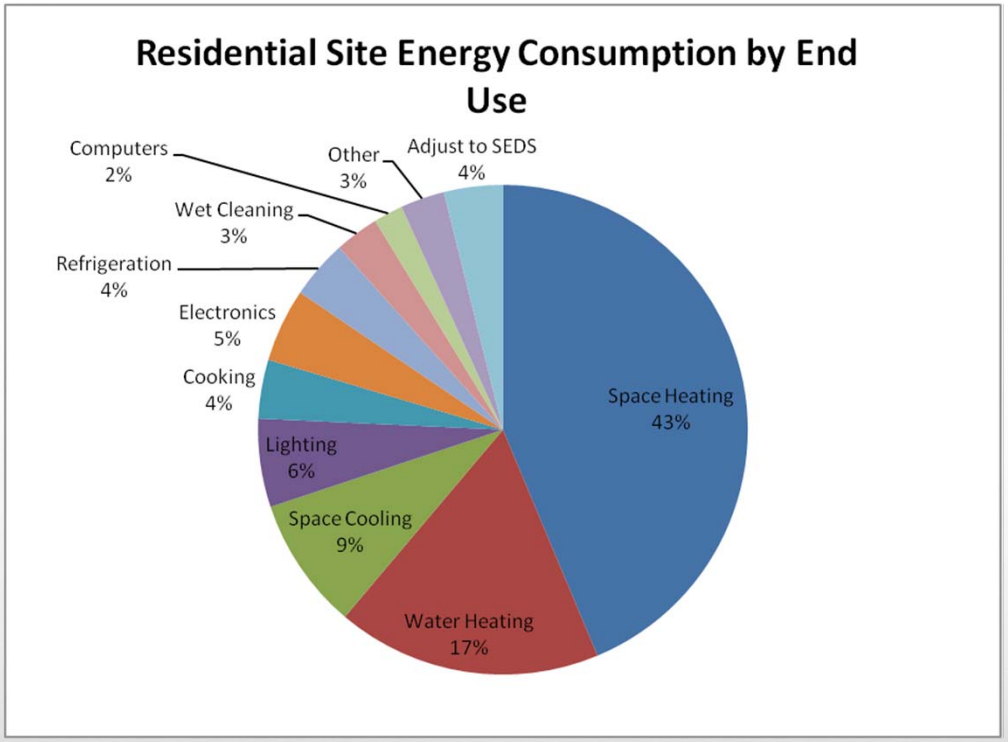
Some Background (from IEA)

- According to the IEA, solar heating and cooling grew by 14% in 2010
- 162 billion kWh of heat collected
- China and Europe account for 78.5% of total systems

Pros

- Renewable and non-polluting
- Low maintenance
- Near-zero operating costs
- Few moving parts
- High efficiency
- Good ROI
- Can be combined with photovoltaic devices

Why bother?



Solar Energy Industries Association http://www.seia.org/research-resources/solar-heating-cooling-technology

Energy Security and Economy Growth

- Can displace the need for natural gas, fuel oil, and electricity
- Reduce dependence on fuel imports
- Positive trade balance: for every dollar invested in SHC, 79 cents will stay in the US
- Create jobs

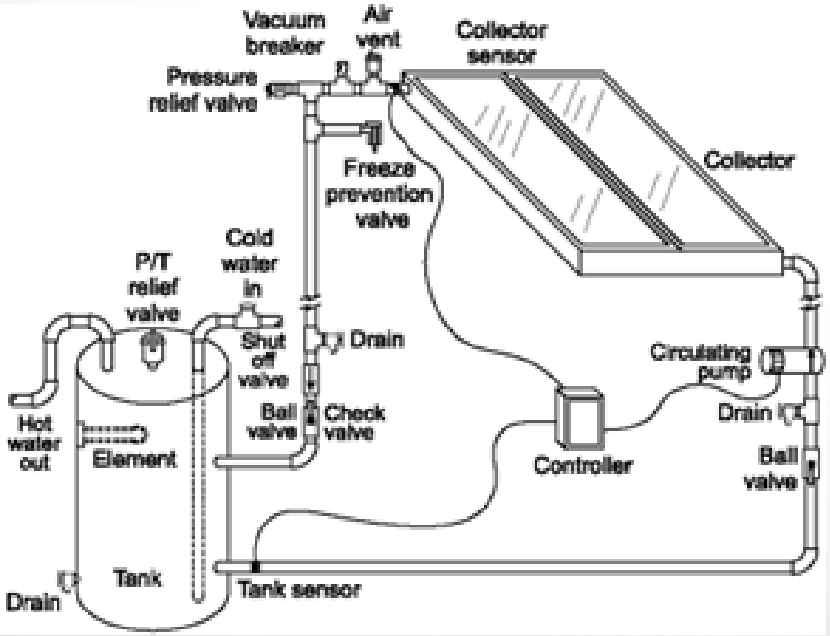
SHC “Umbrella”

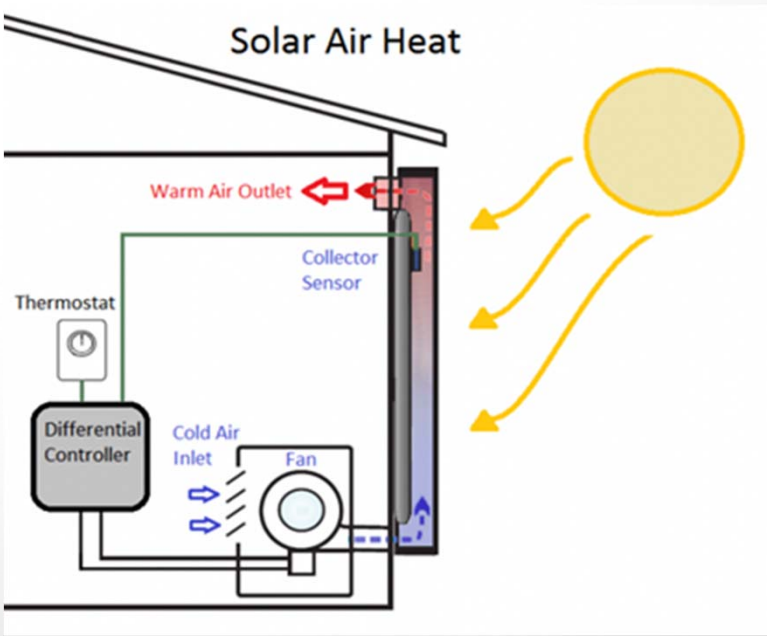
- Solar water heating
- Solar space heating
- Solar cooling (air conditioning)
- Solar pool heating

How does SHC work?

- Solar Heating/Cooling systems trap heat from solar radiation and transfer heat to water or air for use as thermal energy
- Use of collector panels

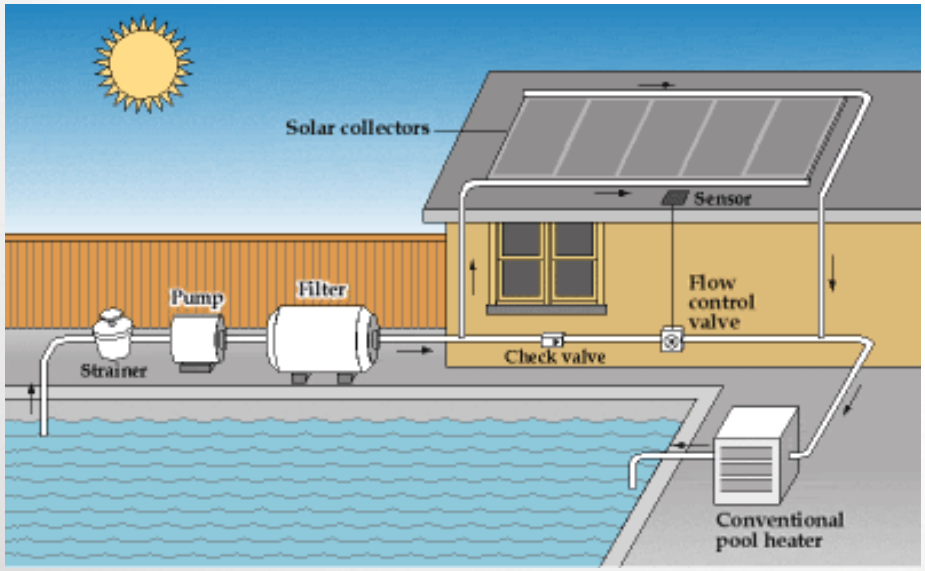
Solar Water Heating: 4 Main Components





Solar water heating mechanism from Solar Energy Industries Association
http://www.seia.org/research-resources/solar-heating-cooling-technology

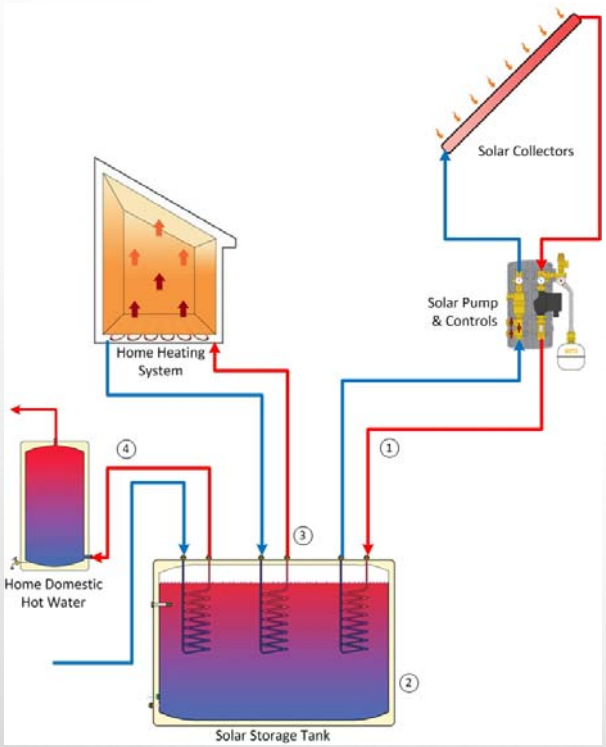
Solar Pool Heating



Solar pool heating system from http://www.emeraldenergync.com/solar-pool-heating.php

- Water circulates through solar collector and temperature is modified as necessary
- Typically use inexpensive, low temperature, unglazed collectors
- Commercial pools are perfect candidates since the temperature must be comfortable
- Pools must be heated year around

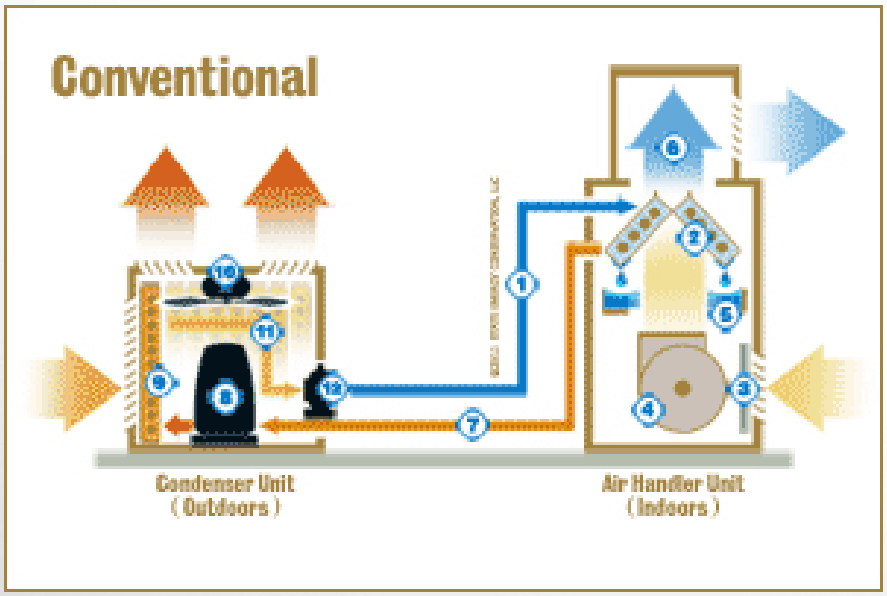
Solar Space Heating

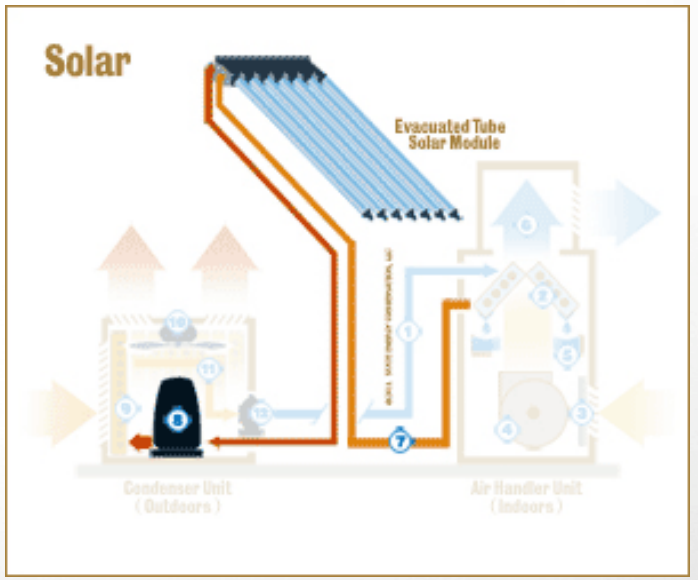


- Works with existing water heating system
- Solar collectors circulate and heat fluid through a solar array
- Hot water from existing system is circulated through a heat exchanger and returned to your heating system
- Significantly shortens amount of time that the system has to run

Solar space heating diagram from
http://www.solarpanelsplus.com/residential/solar-space-heating/

Solar Cooling

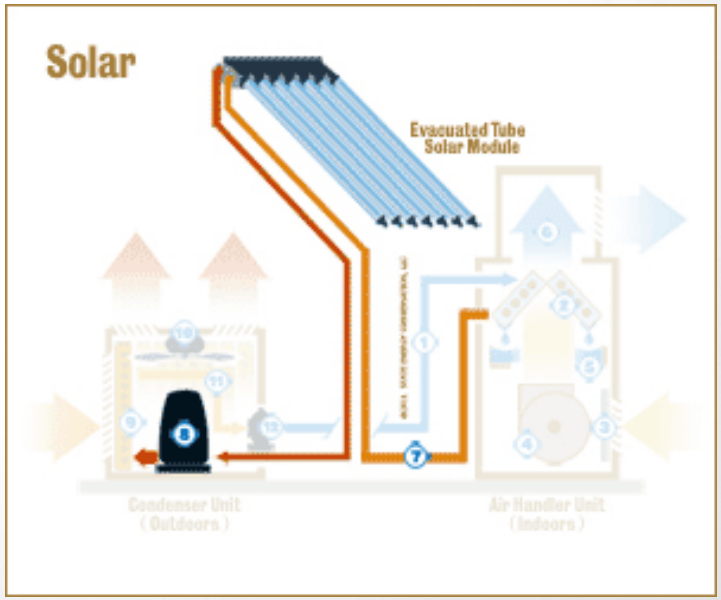




Conventional vs. solar air conditioning from http://www.stateenergy.net/how-solar-air-conditioning-works/

Solar Cooling Cont.

- After refrigerant leaves evaporator coil, it goes through a solar collector
- Refrigerant is pre-heated before entering the compressor
- Refrigerant dumps its energy into the outside air
- Compressor runs less and system uses less electrical energy
- Refrigerant cools as it goes through condenser coil and cycle repeats



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- http://www.seia.org/research-resources/solar-heating-cooling-technology
- http://www.solarpanelsplus.com/
- http://www.triplepundit.com/special/solar-thermal-pros-cons-part-1-solar-heating-cooling/
- http://www.emeraldenergync.com/solar-pool-heating.php
- http://www.stateenergy.net/how-solar-air-conditioning-works/