



Introduction to Solar Water Heating

Presented by City of Chula Vista's Sustainable Communities Program



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Sustainable Communities Program

- Provides resources to stakeholders of the Chula Vista built environment to improve compliance with **energy efficiency** and **green building codes** and to promote construction of **sustainable buildings**.
- Part of the **City of Chula Vista's Local Government Partnership program**, which is funded by California utility customers and administered by San Diego Gas & Electric® under the auspices of the California Public Utilities Commission.

Getting to Zero Net Energy – Workshop Series

- **Streamlined Permitting for Residential Solar PV**
 - Wed, May 6
- **Introduction to Energy Storage**
 - Tues, May 19
- **Electric Vehicle Charging in Buildings**
 - Wed, June 10

Register at www.energycenter.org/events





Center for
Sustainable Energy™

- Independent nonprofit organization
- Our mission: Accelerating the transition to a sustainable world powered by clean energy
 - Program management
 - Training and education
 - Technical assistance

What is “Zero Net Energy”?

A Zero-Net-Energy Code Building is one where the **net amount of energy produced by on-site renewable energy resources** is equal to **the value of the energy consumed annually by the building**, at the level of a single “project” seeking development entitlements and building code permits, measured using the California Energy Commission’s Time Dependent Valuation metric.

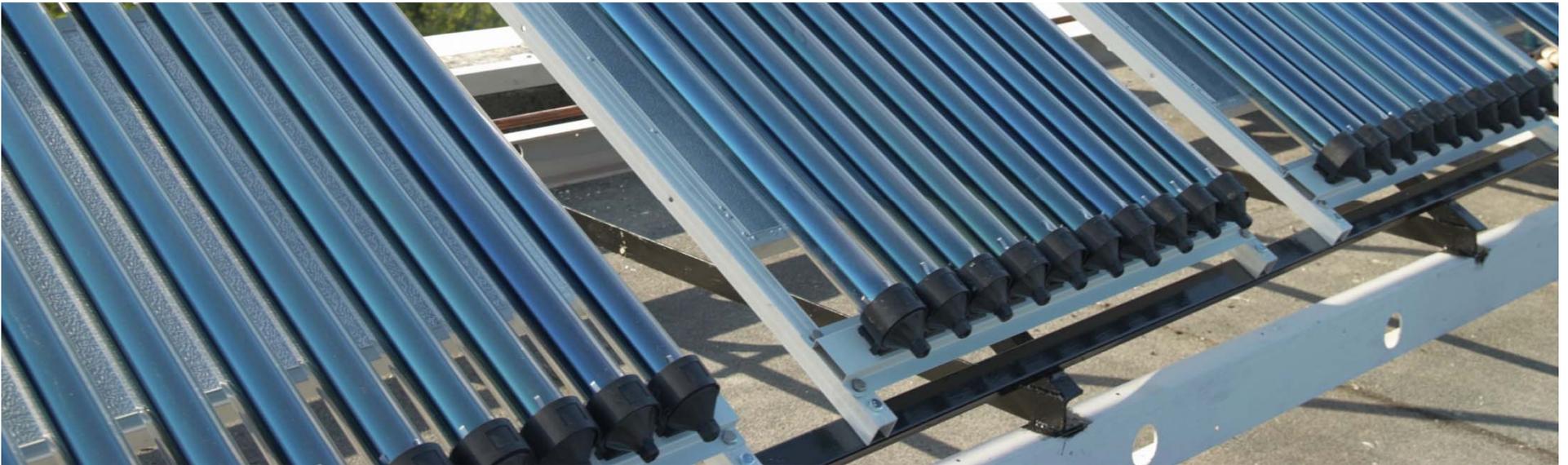
-- California Energy Commission, 2013 Integrated Energy Policy Report

California's ZNE Goals

- All **new residential construction** will be ZNE by 2020
- All new and 50 percent of existing **state-owned public buildings** will be ZNE by 2025
- All **new commercial buildings** will be ZNE by 2030
- 50 percent of **existing commercial buildings** will be retrofit to ZNE by 2030



Solar Water Heating



What we'll cover

- ✓ About Solar Water Heating
- ✓ Solar Water Heating Systems (SWH)
- ✓ Rebate/Incentive Information
- ✓ Project Profile



What is Solar Water Heating?

Captures heat energy from the sun to reduce energy used for water heating or other thermal loads

Domestic Hot Water



For bathing, dishwashing, laundry, cleaning, etc.

Pool and Spa Heating



Don't sweat turning up the temperature.

Space Heating & Cooling



Warm up your building, cool down your energy bill.

Benefits

- Environmental
 - Renewable energy source
 - Reduce harmful greenhouse gases
 - Promote your property as “green”
- Financial
 - Save money – up to 80% on water heating costs



Potential thermal applications

- Single-family homes
- Multifamily complexes, hotels, laundries
- Industrial applications
- Manufacturing processes
- Agricultural/food processing

What you need to know

- Works with any backup
- Works in conjunction with the existing system
- Not required to replace existing water heater
- Can be compatible with tankless



Single Family Solar Water Heating

- Typical SWH system 1-3 collectors (32-120 sq. ft.)
- Size according to gallons of hot water used per day (GPD)
- Number of occupants
 - 1st person= 20 GPD; 2nd person= 15 GPD;
Each person thereafter=10 GPD
- Rules of thumb:
 - 1 ft² of collector area per GPD
 - 1.5 gallons of storage per ft² of collector area

Multifamily/Commercial Solar Thermal

- Most effective with a central boiler
- Rules of thumb DHW:
 - 1 ft² of collector area per GPD
 - 1.5 gallons of storage per ft² of collector area
- System size will vary for other applications based on the temperature needed for that use



Types of Solar Water Heating Systems



Two Basic Types

PASSIVE

No Pumps

1. Integral Collector Storage
2. Thermosyphon System

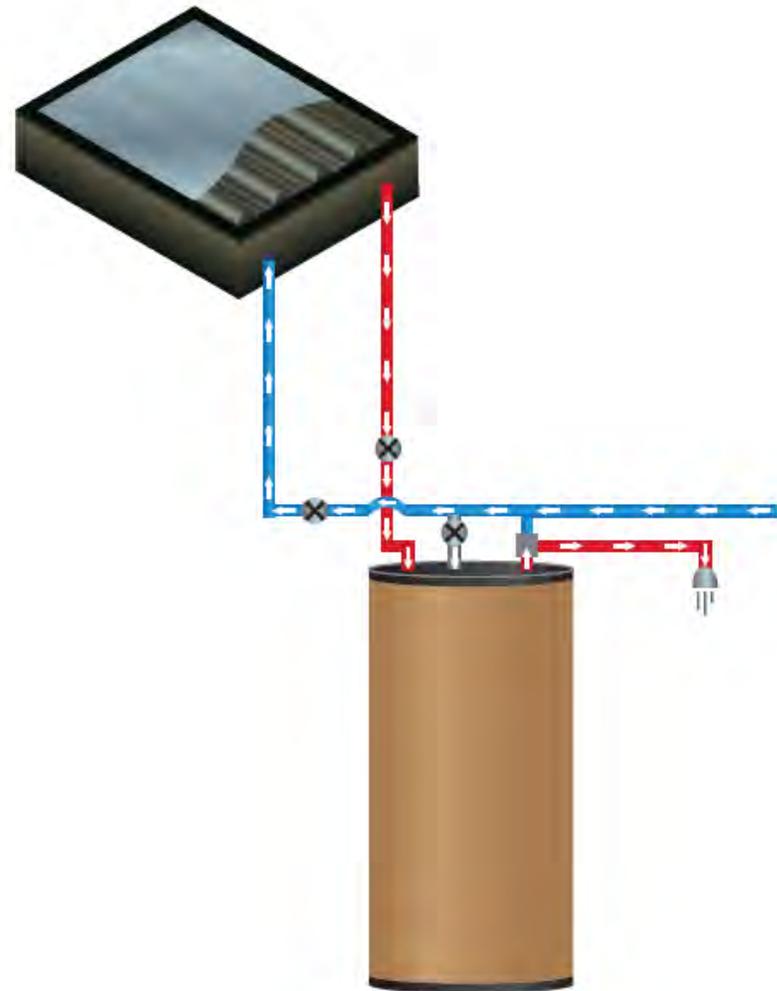
ACTIVE

Pumps move water through the system

3. Direct Forced Circulation
4. Closed-loop – Glycol
5. Closed-loop – Drain-back

1. ICS System – Passive

- No pumps
- Open-loop



1. ICS System – Passive



Pros

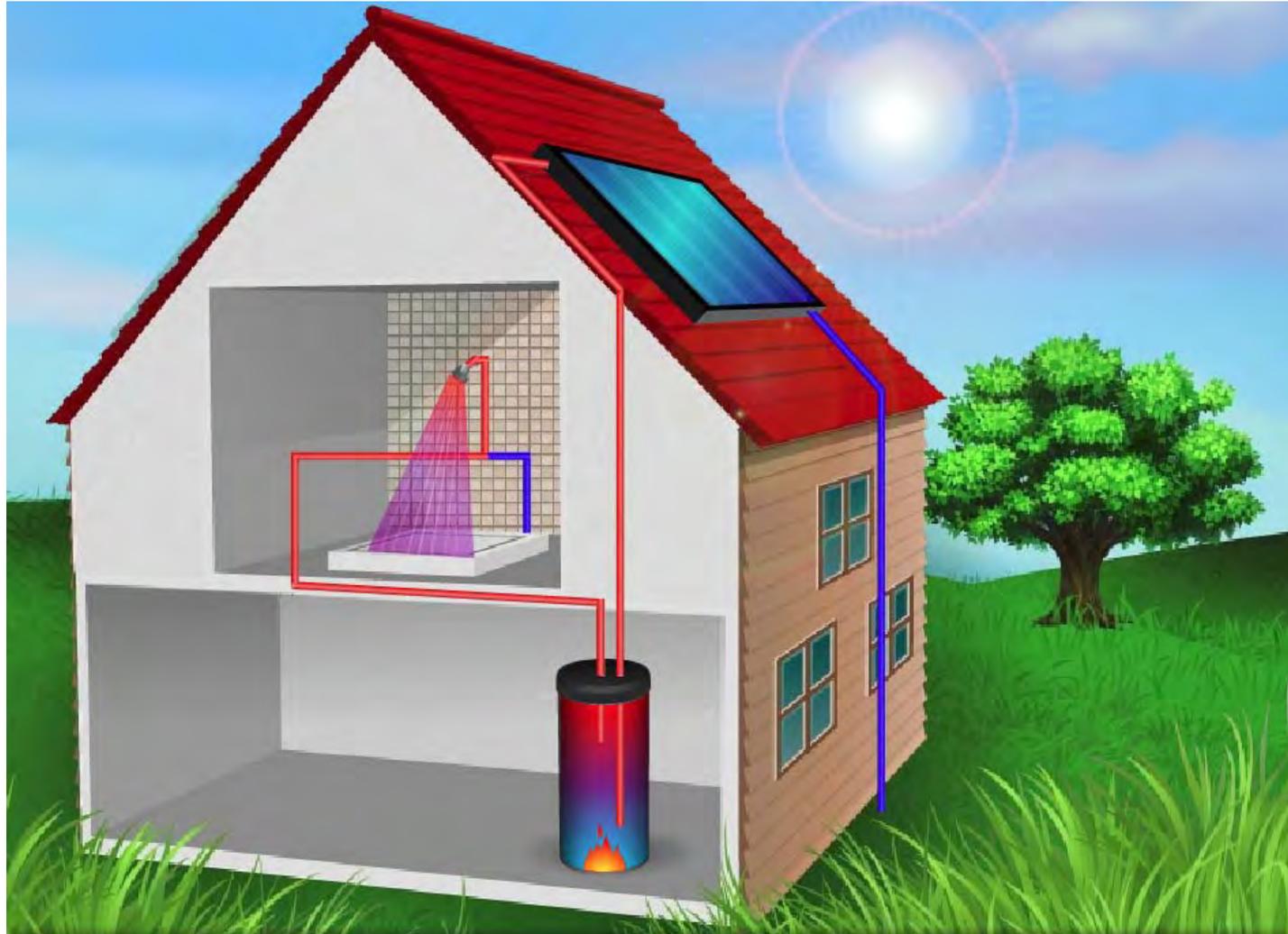
- Simple design—no pumps
- Low cost
- Resistant to freezing in moderate climates



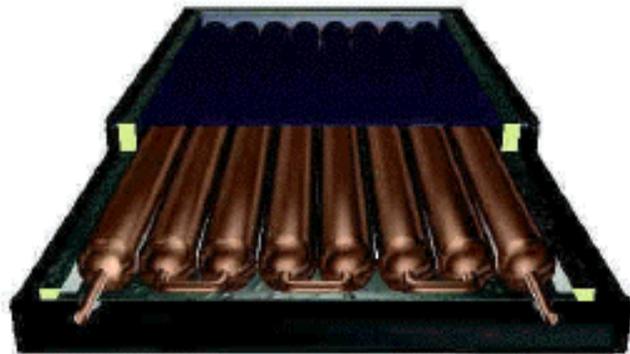
Cons

- Inefficient in cold climates
- Heavy weight on roof (600 – 800 lbs.)

1. ICS System – Passive



1. ICS System – Passive



Water stored in collector

Source: SunEarth

CPAU

 Center for Sustainable Energy[®]

 CITY OF CHULA VISTA

2. Thermosyphon System – Passive

- No pumps
- Closed-loop



2. Thermosyphon System – Passive



Pros

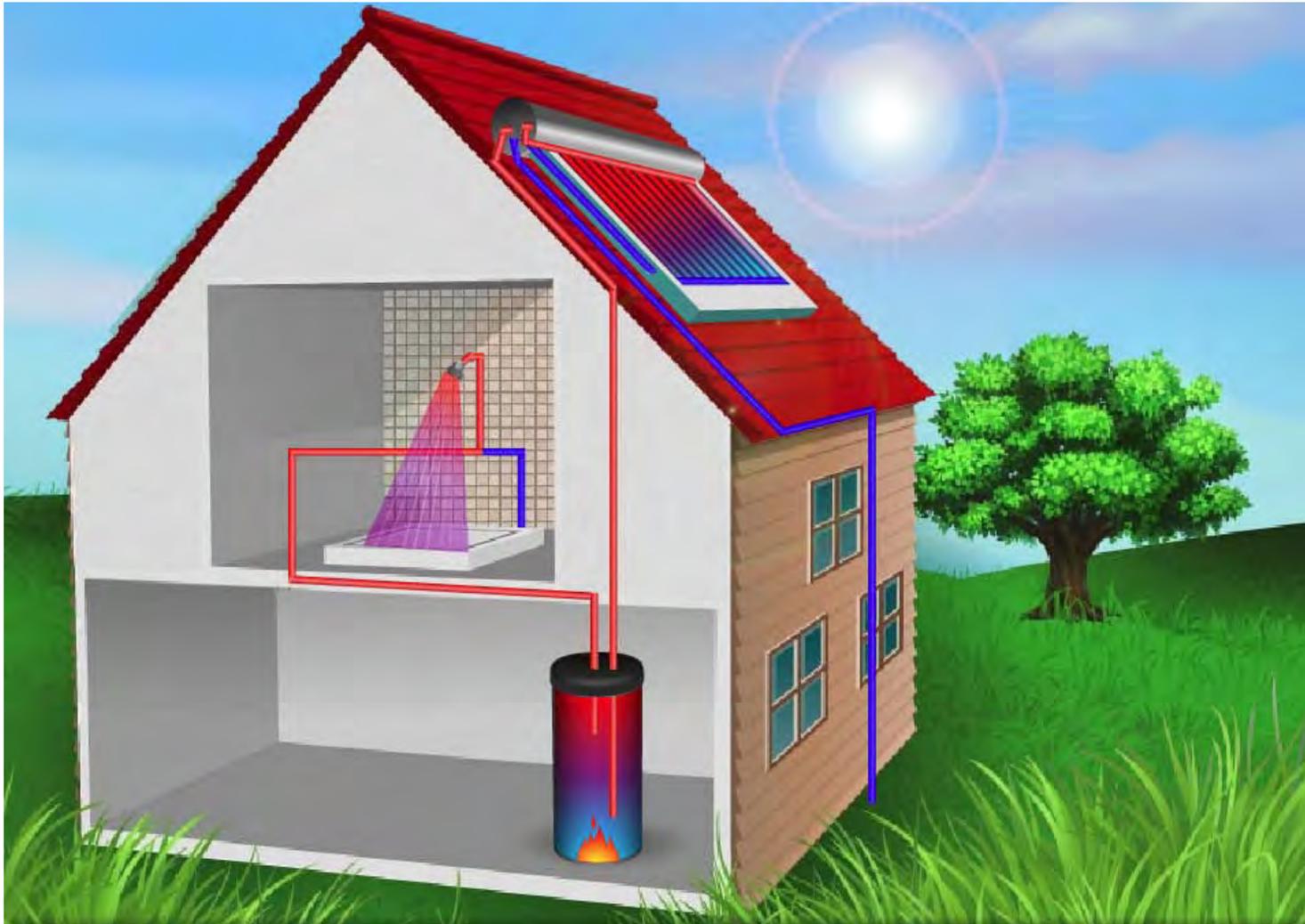
- Simple design—no pumps
- Good in colder climates



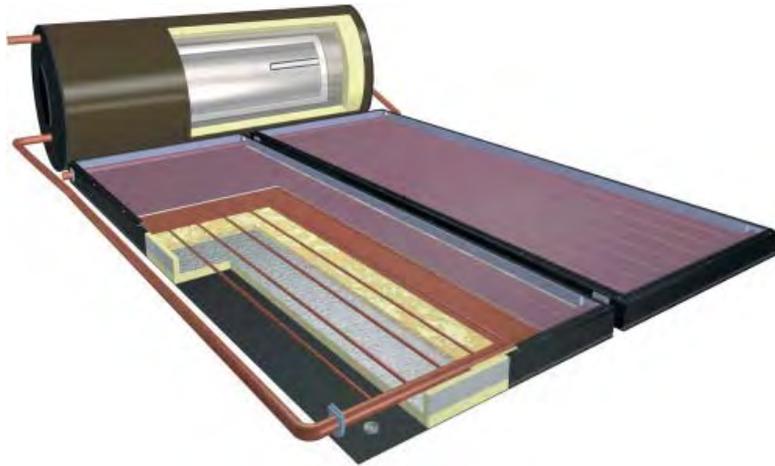
Cons

- Higher roof weight (1,000 – 1,300 lbs.)
- Glycol and heat exchanger reduce efficiency

2. Thermosyphon System – Passive



2. Thermosyphon System – Passive



Source: SunEarth



Source: CleanTech

Two Basic Types

PASSIVE

No Pumps

1. Integral Collector Storage
2. Thermosyphon System

ACTIVE

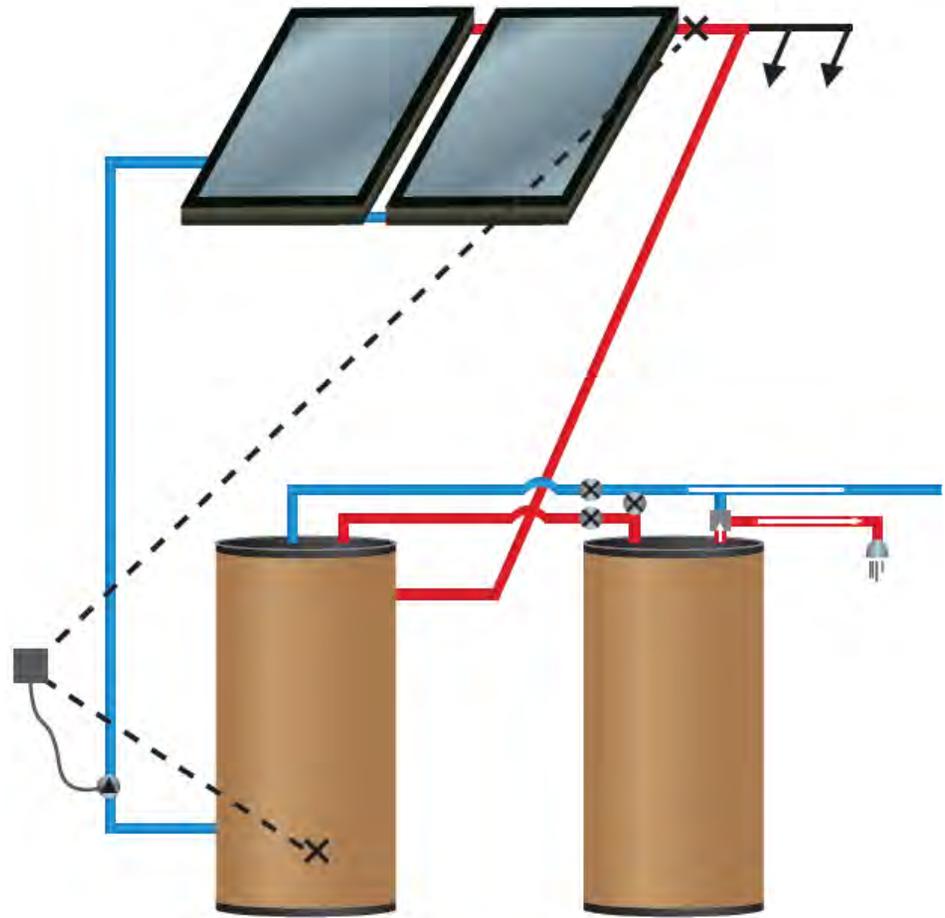
Pumps move water through the system

3. Direct Forced Circulation
4. Closed-loop – Glycol
5. Closed-loop – Drain-back

3. Direct Forced Circulation (DFC) – Active

- Pump/forced
- Open-loop
- Controllers and sensors

DFC systems not eligible for rebate!



3. Direct Forced Circulation (DFC) – Active



Pros

- Simple pump system
- Good for climates with warmer temperatures



Cons

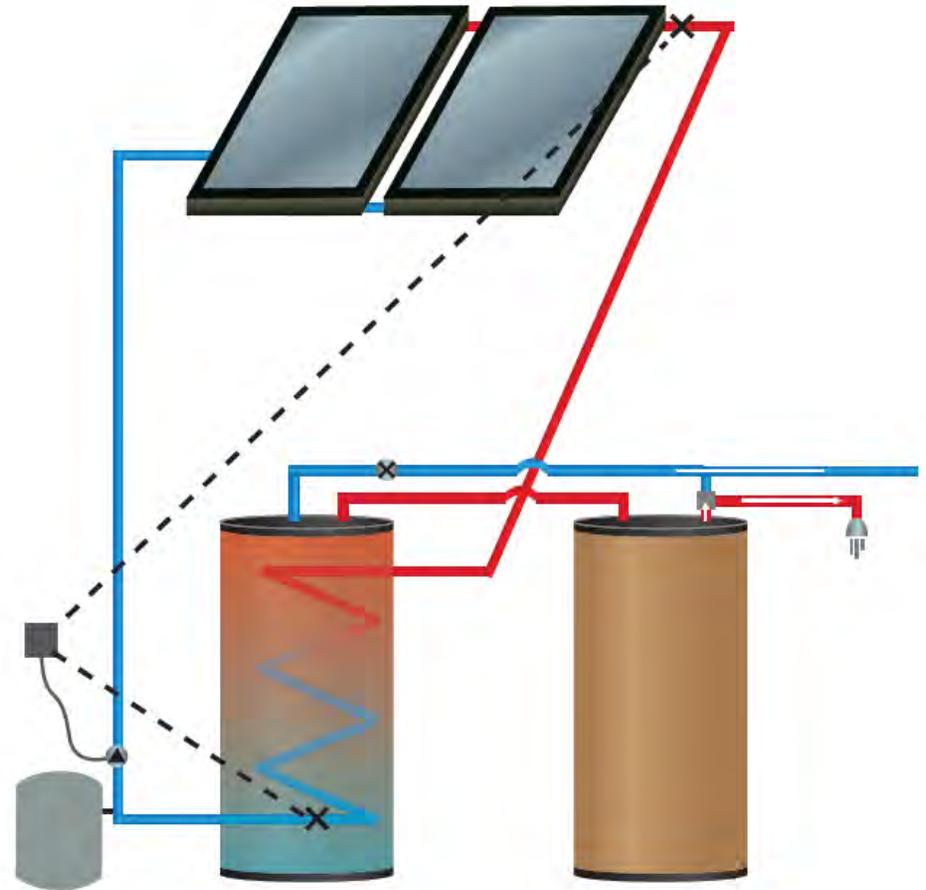
- Risk of freezing in colder climates
- Not appropriate with hard water

DFC systems not eligible for rebate!

4. Indirect Forced Circulation (IFC) – Active

Closed-Loop Glycol

- Pump/forced
- Glycol = Antifreeze
- Controllers and sensors
- Expansion tank
- Storage tank



4. Indirect Forced Circulation (IFC) – Active

Closed-Loop Glycol



Pros

- Frequently installed by solar companies
- Good for cold climates
- Better with hard water

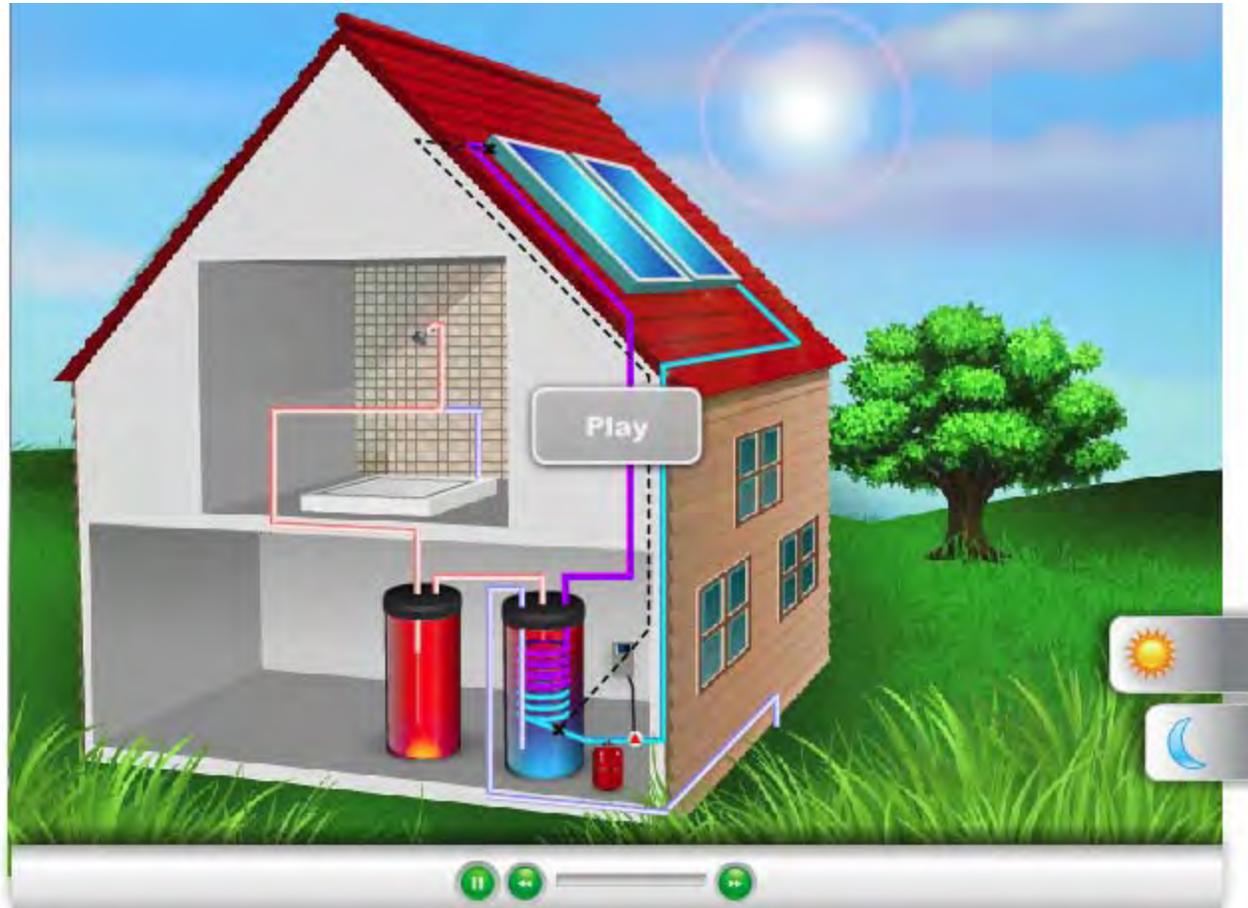


Cons

- Heat exchanger and antifreeze reduce efficiency
- Antifreeze may break down at high temperatures

4. Indirect Forced Circulation (IFC) – Active

Closed-Loop Glycol



4. Indirect Forced Circulation (IFC) – Active

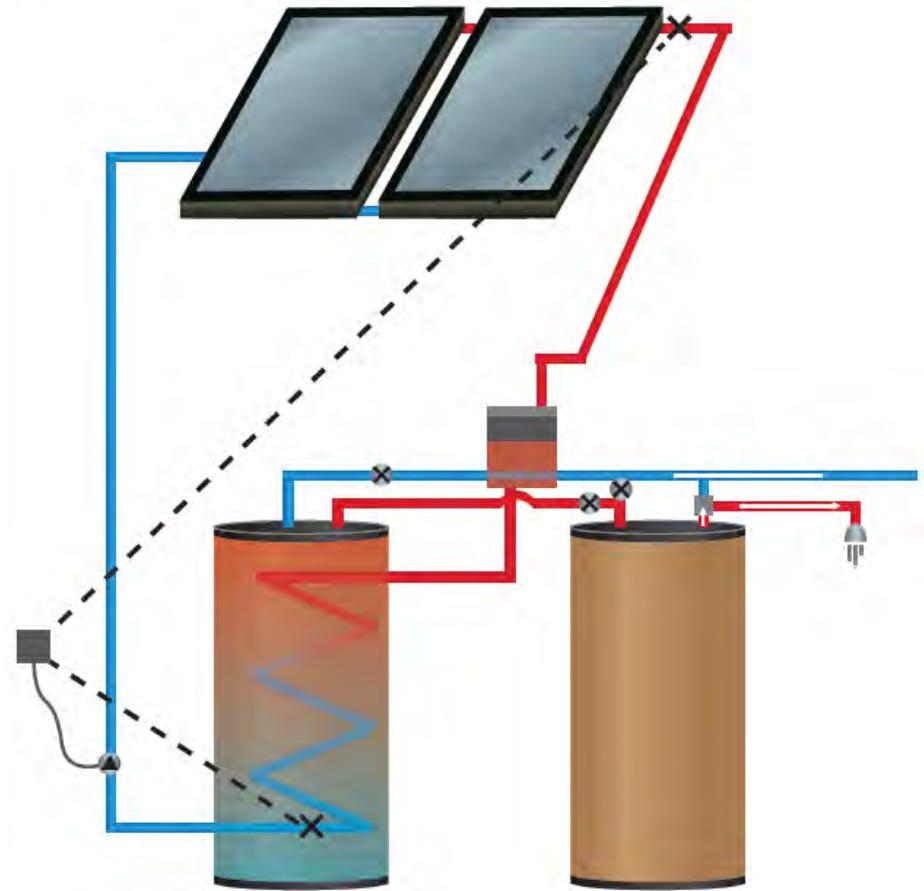
Closed-Loop Glycol



5. Indirect Forced Circulation (IFC) – Active

Closed-Loop Drain-Back

- Pump/forced
- Water and air circulate
- Controllers and sensors
- Drain-back reservoir



5. Indirect Forced Circulation (IFC) – Active

Closed-Loop Drain-Back



Pros

- Excellent in cold climates
- Excellent in hot climates
- No glycol
- Can use tap water

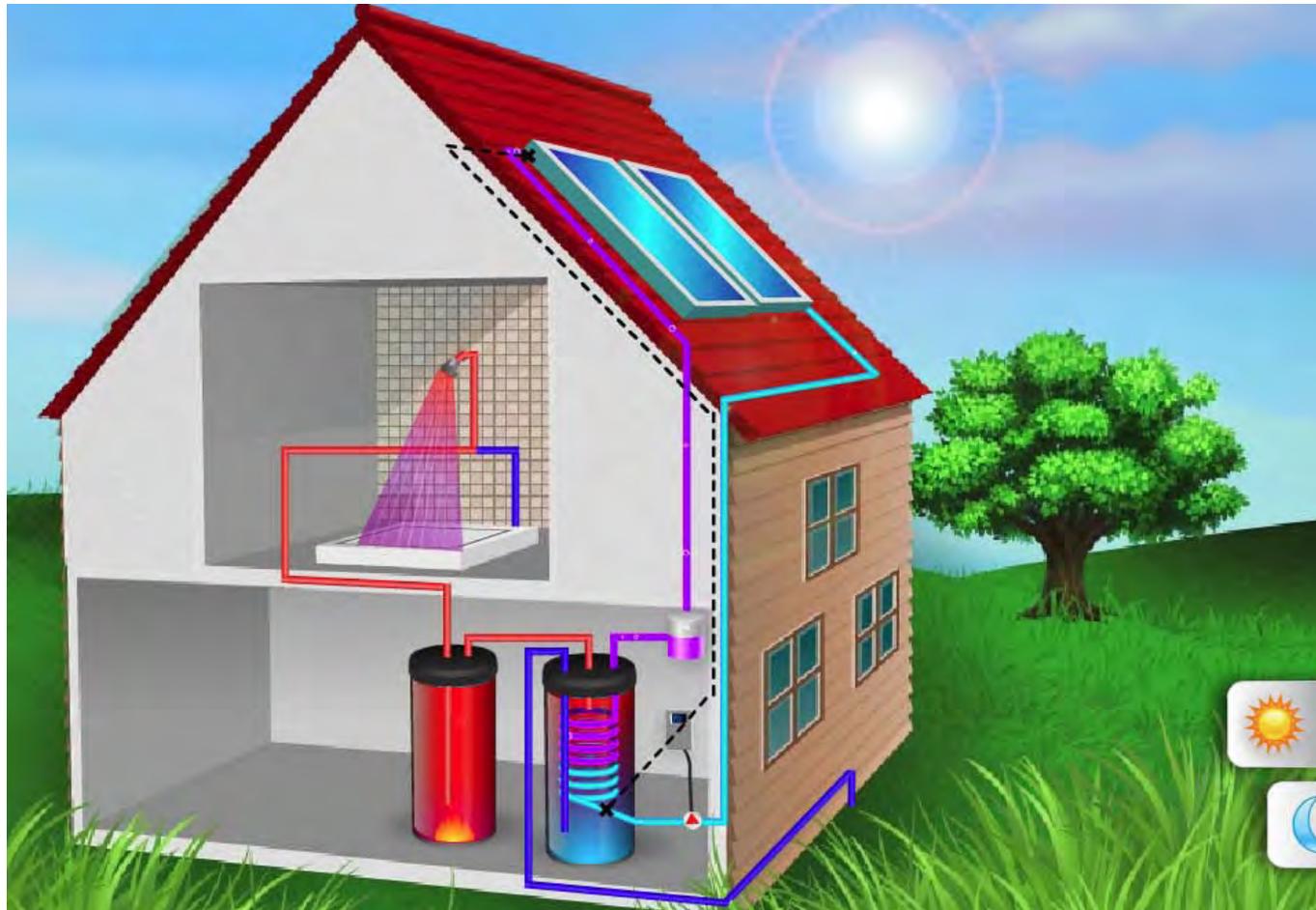


Cons

- Proper slope important
(pipes and collector)
- Heat exchanger reduces efficiency
- Larger pump required

5. Indirect Forced Circulation (IFC) – Active

Closed-Loop Drain-Back



5. Indirect Forced Circulation (IFC) – Active

Closed-Loop Drain-Back



Collector Types





California Solar Initiative – Thermal Program



CSI-Thermal Program Background

- Ratepayer funded rebate program
- For customers of the 4 California Investor Owned Utilities overseen by the California Public Utilities Commission
 - San Diego Gas & Electric (CSE program administrator)
 - Southern California Gas
 - Pacific Gas & Electric
 - Southern California Edison

CSI-Thermal Program Background

- Rebate available for natural gas displacing systems
- Rebates reduce over time as more systems are installed
- Program in place through 2017 or when the rebate funds run out

CSI-Thermal Program

Customer Eligibility

- Single-family Residential
 - Multifamily Residential
 - Commercial
 - Low Income*
 - Single-family
 - Multifamily
- *currently waitlisted



CSI-Thermal Program

Eligible Single Family End Uses

- Domestic water heating



CSI-Thermal Program

Eligible Multifamily/Commercial End Uses

- Domestic water heating
- Process heat
- Space Cooling
- Space Heating
- Combination Systems
- Pool Heating



CSI-Thermal Program

Rebate Budget:

- \$180,000,000 for natural gas displacing systems
- 10% of the total rebate budget is reserved for single-family residential customer SWH systems
- 60% of the total rebate budget is reserved for commercial or multifamily solar thermal systems
- 30% of the total rebate budget is reserved for commercial, multifamily, or institutional solar pool systems
- \$25M Low-Income Program

Incentive Budget Per Program Administrator

Program Administrator	Natural Gas Budget (\$ millions)
PG&E	\$70.2
CSE	\$18.0
SoCalGas	\$91.8
Total	\$180.0

Low Income Program

- Available to qualifying natural gas-displacing SWH systems
- Total budget of the Low Income Program is \$25 million
- CSE is on a waitlist

Program Administrator	Budget Allocation	Total Incentive Budget (in millions)
PG&E	39%	\$9.75
CSE	10%	\$2.50
SCG	51%	\$12.75
Total	100%	\$25

Rebate Payments

- Solar DHW & Solar Pool Systems
 - One-time lump sum payment after system installation
- “Other” thermal end uses
 - Performance Based Incentive (PBI)
 - Rebate paid based on actual, metered performance of the system
 - Payments made quarterly over two years

Incentive Structure

Natural Gas DHW – Single Family

Gas Displacing Incentive Structure			
Step	Customer Class	\$/therm displaced	Maximum Incentive
1	Single Family	\$29.85	\$4,366
2	Single Family	\$25.37	\$3,710
3	Single Family	\$14.30	\$2,091
4	Single Family	\$3.23	\$472

Incentive Structure

Natural Gas DHW – Commercial/Multifamily

Gas Displacing Incentive Structure			
Step	Customer Class	\$/therm displaced	Maximum Incentive
1	Commercial/Multifamily	\$20.19	\$800,000
2	Commercial/Multifamily	\$17.16	\$800,000
3	Commercial/Multifamily	\$10.15	\$800,000
4	Commercial/Multifamily	\$3.13	\$800,000

Incentive Structure

Natural Gas Solar Pools –
Commercial/Multifamily/Institutional
-50% cap of total system cost

Gas Displacing Incentive Structure			
Step	Customer Class	\$/therm displaced	Maximum Incentive
1	Commercial/Multifamily	\$5.00	\$500,000
2	Commercial/Multifamily	\$5.00	\$500,000
3	Commercial/Multifamily	\$4.00	\$500,000
4	Commercial/Multifamily	\$3.00	\$500,000

CSI Thermal Tracker

- Monitor available funding in each step (Live)
- Monitor allocated incentive totals by:
 - Program Administrator
 - Customer Class (residential vs. commercial)
 - Fuel Type (natural gas vs. electric/propane)
- Helpful when approaching a decrease in incentive step level
- Available at: www.csithermal.com/tracker

Rebate Calculation

- DHW & solar pools based on the expected performance of the system
 - Program calculators publicly available and embedded in the application
 - Single-family
 - Multifamily/Commercial DHW
 - Multifamily/Commercial Solar Pools
- www.csithermal.com

Systems

- Collectors must be OG-100 certified and single-family systems must be OG-300 certified by either SRCC or IAPMO
- Systems must have a permit from the local jurisdiction
- Larger systems must install monitoring
- PBI systems must be metered and data provided to the program by a Performance Data Provider

Application Process

- Fully automated online processing database www.csithermal.com
- Users must attend a one-day workshop with one of the program administrators and receive a unique registration key
- Contractors must have one of the following active licenses:
 - A, B, C-4, C-36, C-46

Application Process

- Application must be completed using the CSI-Thermal online database:
www.csithermal.com
- Eligible Contractor completes the application for the customer
- Documents may be submitted online or by mail
- Online documents must be in pdf format
- Program inspection may be required

Wait... There's more!

30% Federal Tax Credit



Project Profile: 116 units

Project Costs

- System cost: \$206,140
- CSI-Thermal Rebate: \$124,502
- Federal Tax Credit: \$24,491
- Total out of pocket: **\$57,147**

Project Savings

- \$7,036 annual energy savings



Site & System:

72 flat plate collectors

Questions?

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