

THERMAL SOLAR DESIGN FOR POOL

Conversion factors:

$$1 \text{ gal H}_2\text{O} = 3.79 \text{ kg}$$

$$1 \text{ gal/min} = 227.27 \text{ kg/hr.}$$

$$1 \text{ hp} = 746 \text{ watts}$$

$$1 \text{ gal} = 0.0038 \text{ m}^3$$

$$^{\circ}\text{C} = 5/9(^{\circ}\text{F} - 32)$$

NEEDS FOR SOLAR THERMAL DESIGN FOR POOL

POOL

1. Total capacity of water in pool and ancillary storage; **250,000 gal = 947,000 kg = 3598.6 m³**

(a) Separate size of storage(if available)

2. Flow rate of water during use; **350 gpm = 79544.5 kg/hr**

3. Desired temperature of water; **82F = 27.8C**

4. Power (V, A, phases, PF)/hp/flow design of water pump(s); **208 V, 3 ϕ**

$$\mathbf{2-15 \text{ hp} = 22380 \text{ W}}$$

$$\mathbf{1-10 \text{ hp} = 7460 \text{ W}}$$

$$\mathbf{1-5 \text{ hp} = 3730 \text{ W}}$$

$$\mathbf{\text{TOTAL ELECTRICAL (POOL)} = 33570 \text{ W} = 33.57 \text{ kW}}$$

5. Other: **40 ton unit, 208 V, 3 ϕ , 2-35 hp compressors = 52220 W = 52.22 kW**

SPA

1. **10,000 gal = 37,900 kg = 144 m³**

2. **2-7.5 hp = 22389 W = 22.389 kW, 208V, 3 ϕ**

3. **Water 102 F = 38.9C, space 84F = 28.9C**

JVM 10/18/2016

Location and Resource

Solar Water Heating

System Costs

Lifetime

Financial Parameters

Incentives

Electricity Rates

Electric Load

Download a weather file from the NREL NSRDB

Download...
 Click Download and type a street address or latitude and longitude to download a weather file from the NREL NSRDB for United States and some international locations. SAM adds the downloaded file to the solar resource library so it will appear in the list below.

[NSRDB Map](#)

Choose a weather file from the solar resource library

Click a name in the list to choose a file from the library. Type a few letters of the name in the search box to filter the list. If your location is not in the library downloading a file (see above).

Search for: Name

Name	Station ID	Latitude	Longitude	Time zone	Elevation
USA MD Patuxent River Nas (TMV3)	724040	38.3	-76.417	-5	14
USA MD Salisbury Wilcomico Co Ap (TMV3)	724045	38.333	-75.517	-5	15
USA ME Auburn-Lewiston (TMV3)	726184	44.05	-70.283	-5	88
USA ME Augusta Airport (TMV3)	726185	44.317	-69.8	-5	107
USA ME Bangor International Ap (TMV3)	726088	44.8	-68.817	-5	56
USA ME Bangor Harbor (TMV3)	726077	44.85	-68.857	-5	26

Tools

[View data...](#)

[Refresh library](#)

[Folder settings...](#)

[Open library folder.](#)

City: Time zone: Latitude:
 State: Elevation: Longitude:
 Country: Data Source: Station ID:
 Data file:

Annual Weather Data Summary

Global horizontal	<input type="text" value="3.88"/> kWh/m ² /day	Average temperature	<input type="text" value="7.4"/> °C
Direct normal (beam)	<input type="text" value="4.01"/> kWh/m ² /day	Average wind speed	<input type="text" value="3.6"/> m/s
Diffuse horizontal	<input type="text" value="1.68"/> kWh/m ² /day		

[Visit SAM weather data website](#)

Simulate >



Parameters Stochastic



Use a specific weather file on disk

Hot Water Draw

Hourly hot water draw profile kg/hr Scale draw profile to average daily usage

Total annual hot water draw kg/year Average daily hot water usage kg/day

System

Tilt	<input type="text" value="30"/> deg	Diffuse sky model	<input type="text" value="Isotropic"/>
Azimuth	<input type="text" value="180"/> deg	Irradiance inputs	<input type="text" value="Beam and Diffuse"/>
Total system flow rate	<input type="text" value="22.1"/> kg/s	Albedo	<input type="text" value="0.2"/> <input type="text" value="0.1"/>
Working fluid	<input type="text" value="Glycol"/>	Total system collector area	<input type="text" value="32"/> m ²
Number of collectors	<input type="text" value="8"/>	Rated system size	<input type="text" value="18.704"/> kW

Shading

Curtailment and Availability Constant loss: 0.0 %
Hourly losses: None
Custom periods: None

Collector

Enter user-defined parameters
 Choose from library

User-defined collector

Collector area	<input type="text" value="4"/> m ²
FRta	<input type="text" value="0.7"/>
FRUL	<input type="text" value="3.85"/> W/m ² .C
Incidence angle modifier	<input type="text" value="0.2"/>
Test fluid	<input type="text" value="Glycol"/>
Test flow	<input type="text" value="0.06"/> kg/s

Name	SRCC Number	Type	Area	IAMI	FRta
Thermo Dynamics Ltd. Micro-Flo S32-P	2009007A	Glazed Flat-Plate	2.98	0.34	0.685
TISUN LLC TISUN FM-W S 4	2007054A	Glazed Flat-Plate	2.55	0.17	0.733
TISUN LLC TISUN FA 2 5	2007052C	Glazed Flat-Plate	10.1	0	0.732
TISUN LLC TISUN FA 2 6	2007052D	Glazed Flat-Plate	12.1	0	0.731
TISUN LLC TISUN FA 2 3	2007052B	Glazed Flat-Plate	6.1	0	0.726
TISUN LLC TISUN FA 2 4	2007052A	Glazed Flat-Plate	8.08	0	0.708
TrendSetter Solar Products Inc. Trendsetter TS-22-S	2007029B	Tubular	3.16	-0.09	0.355
TrendSetter Solar Products Inc. Trendsetter TS-30-S	2007029A	Tubular	4.02	-1.29	0.355
Tsinghua Solar Systems Ltd. Tsinghua Solar SLU-1500 12	2007034Ai	Tubular	1.28	-1.8	0.3

Solar Tank and Heat Exchanger

Solar tank volume m3

Solar tank height to diameter ratio

Solar tank heat loss coefficient (U value) W/m2.C

Solar tank maximum water temperature C

Heat exchanger effectiveness 0..1

Outlet set temperature C

Mechanical room temperature C

Piping and Pumping

Total piping length in system m

Pipe diameter m

Pipe insulation conductivity W/m.C

Pipe insulation thickness m

Pump power W

Pump efficiency 0..1

Advanced

Use custom mains profile

Hourly custom mains profile C

Use custom set temperatures

Hourly custom set temperatures C

Direct Capital Costs

Number of Collectors	<input type="text" value="8"/>	Collector cost	<input type="text" value="600.00"/> \$/m2	<input type="text" value="\$ 19,200.00"/>
		Storage cost	<input type="text" value="0.00"/> \$/m3	<input type="text" value="\$ 0.00"/>
		Balance of system		<input type="text" value="\$ 4,000.00"/>
		Installation cost		<input type="text" value="\$ 2,000.00"/>
		Contingency	<input type="text" value="0 %"/>	<input type="text" value="\$ 0.00"/>
Total direct cost				<input type="text" value="\$ 25,200.00"/>

Indirect Capital Costs

	% of Direct Cost	Non-fixed Cost	Fixed Cost	Total
Engineer, Procure, Construct	<input type="text" value="0 %"/>	<input type="text" value="\$ 0.00"/>	<input type="text" value="\$ 0.00"/>	<input type="text" value="\$ 0.00"/>
Project, Land, Miscellaneous	<input type="text" value="0 %"/>	<input type="text" value="\$ 0.00"/>	<input type="text" value="\$ 0.00"/>	<input type="text" value="\$ 0.00"/>
Sales tax of	<input type="text" value="0 %"/>	applies to	<input type="text" value="100 %"/>	of direct cost
Total indirect cost				<input type="text" value="\$ 0.00"/>

Total Installed Costs

Total Installed Cost excludes financing costs
(if any, see Financing Page)

Total installed cost	<input type="text" value="\$ 25,200.00"/>
Total installed cost per capacity (\$/Wt)	<input type="text" value="\$ 1.35"/>

Operation and Maintenance Costs

	Value	First year cost	Escalation rate (above inflation)	In Value mode, SAM applies both inflation and escalation to the first year cost to calculate out-year costs. In Schedule mode, neither inflation nor escalation applies. See Help for details.
Fixed annual cost	<input type="text" value="0"/> \$/yr	<input type="text" value="0"/> \$/yr	<input type="text" value="0 %"/>	
Fixed cost by capacity	<input type="text" value="50"/> \$/kW-yr	<input type="text" value="50"/> \$/kW-yr	<input type="text" value="0 %"/>	
Variable cost by generation	<input type="text" value="0"/> \$/MWh	<input type="text" value="0"/> \$/MWh	<input type="text" value="0 %"/>	

Input Time Series Load Data ▾

Electric Load Data

Energy usage kW

Normalize supplied load profile to monthly utility bill data

Scaling factor (optional)

Monthly energy usage kWh

Monthly Load Summary

	Energy (kWh)	Peak (kW)
Jan	25,415.11	46.14
Feb	22,835.96	46.12
Mar	25,201.86	47.77
Apr	24,737.45	56.53
May	26,684.73	58.68
Jun	29,219.67	69.53
Jul	32,255.26	71.41
Aug	31,188.28	70.87
Sep	27,258.54	68.01
Oct	25,595.31	51.36
Nov	24,607.17	47.10
Dec	25,465.73	46.08
Annual	320,465.09	71.41

Annual Adjustment

Load growth rate %/yr

In Value mode, the growth rate applies to the previous year's annual kWh load starting in Year 2. In Schedule mode, each year's rate applies to the Year 1 kWh value. See Help for details.

Metric	Value
Annual energy saved (year 1)	229,502 kWh
Solar fraction (year 1)	0.01
Aux with solar (year 1)	35,499,924.0 kWh
Aux without solar (year 1)	35,967,932.0 kWh
Capacity factor (year 1)	140.1%
Levelized COE (nominal)	0.83 c/kWh
Levelized COE (real)	0.64 c/kWh
Electricity bill without system (year 1)	\$38,456
Electricity bill with system (year 1)	\$11,157
Net savings with system (year 1)	\$27,299
Net present value	\$220,019
Payback period	1.0 years
Net capital cost	\$25,200
Equity	\$12,600
Debt	\$12,600





