

Enerpool v. 2.1.6 - Swimming Pool Simulation
 Simulation File: C:\ENERPOOL\SANDA.EPL
 Run on: Fri Feb 07 19:27:43 2003

POOL CONFIGURATION:

- Solar Collector
- No Heat Exchanger
- Auxiliary Heater
- Weather file: C:\ENERPOOL\SAND.TMY
- No Alternate Input File

POOL CHARACTERISTICS:

Pool Volume: 72.8 m3
 Pool Area : 47 m2
 Evaporation Model: RSPEC
 Wind Correction Factor (Pool): 0.14

SOLAR SYSTEM CHARACTERISTICS:

Collector Type: Unglazed
 Total Collector Area: 37.12 m2

SIMULATION SUMMARY

	Passive	Active	Auxiliary	Total	Residual	Average
Mon	Gains	Gains	Heating	Losses	Gains	T Pool
	(GJ)	(GJ)	(GJ)	(GJ)	(GJ)	(C)
Jan	9.55	9.63	0.00	18.91	0.28	19.61
Feb	11.62	10.84	0.00	21.39	1.07	22.75
Mar	16.26	13.23	0.00	28.81	0.68	26.20
Apr	18.70	13.68	0.00	30.96	1.43	28.47
May	20.08	13.23	0.00	33.85	-0.54	30.73
Jun	19.51	12.51	0.00	30.67	1.35	30.89
Jul	22.07	14.65	0.00	36.08	0.64	34.52
Aug	21.25	15.69	0.00	37.15	-0.21	35.31
Sep	16.57	13.24	0.00	31.45	-1.64	33.55
Oct	13.95	12.69	0.00	27.11	-0.48	28.44
Nov	10.30	9.89	0.00	22.57	-2.38	24.61
Dec	8.77	9.18	0.00	18.57	-0.63	20.57
Tot	188.63	148.46	0.00	337.53	-0.44	28.00

LOSSES SUMMARY

	Evapor.	Convect.	Conduct.	Radiat.	Side	Makeup	Total
Mon	Losses	Losses	Losses	Losses	Losses	Losses	Losses
	(GJ)	(GJ)	(GJ)	(GJ)	(GJ)	(GJ)	(GJ)
Jan	3.33	4.78	0.15	10.49	0.00	0.14	18.91
Feb	3.79	5.91	0.35	11.14	0.00	0.20	21.39
Mar	5.41	8.65	0.53	13.89	0.00	0.32	28.81
Apr	6.30	9.53	0.58	14.15	0.00	0.39	30.96
May	7.89	10.14	0.67	14.65	0.00	0.51	33.85
Jun	6.98	9.47	0.65	13.09	0.00	0.47	30.67
Jul	8.54	10.96	0.80	15.16	0.00	0.63	36.08
Aug	9.45	10.69	0.82	15.50	0.00	0.69	37.15
Sep	7.92	8.96	0.72	13.27	0.00	0.57	31.45
Oct	6.04	7.15	0.58	12.95	0.00	0.39	27.11
Nov	4.34	6.12	0.44	11.42	0.00	0.26	22.57
Dec	3.08	4.79	0.33	10.21	0.00	0.16	18.57
Tot	73.09	97.16	6.61	155.93	0.00	4.73	337.53

SOLAR SUMMARY

	Available	Collected	Piping	Pump	Active
Mon	Energy	Energy	Losses	Gains	Gains
	(GJ)	(GJ)	(GJ)	(GJ)	(GJ)
Jan	16.42	9.58	0.01	0.07	9.63
Feb	18.62	10.79	0.01	0.06	10.84
Mar	24.07	13.17	0.02	0.07	13.23
Apr	25.47	13.63	0.02	0.07	13.68
May	25.84	13.18	0.02	0.07	13.23
Jun	24.44	12.46	0.02	0.07	12.51
Jul	27.99	14.60	0.03	0.08	14.65
Aug	28.38	15.64	0.02	0.07	15.69
Sep	23.52	13.19	0.02	0.07	13.24
Oct	21.86	12.64	0.02	0.07	12.69
Nov	17.40	9.84	0.01	0.06	9.89
Dec	15.55	9.12	0.01	0.06	9.18
Tot	269.55	147.83	0.20	0.83	148.46

PRIMARY ENERGY CONSUMPTION SUMMARY

	Time	Time Aux.	Electric.	Primary
Mon	Pump On	Heat On	Energy	Energy

	(h)	(h)	(kWh)	(GJ)
Jan	243.00	0.00	182.25	0.00
Feb	225.00	0.00	168.75	0.00
Mar	264.00	0.00	198.00	0.00
Apr	265.00	0.00	198.75	0.00
May	277.00	0.00	207.75	0.00
Jun	270.00	0.00	202.50	0.00
Jul	285.00	0.00	213.75	0.00
Aug	270.00	0.00	202.50	0.00
Sep	253.00	0.00	189.75	0.00
Oct	252.00	0.00	189.00	0.00
Nov	224.00	0.00	168.00	0.00
Dec	240.00	0.00	180.00	0.00
Tot	3068.00	0.00	2301.00	0.00

SYSTEM PARAMETERS

CONFIGURATION

Pool Configuration

Solar Collector : X
Heat Exchanger : -
Auxiliary Heater : X
Use Alternate Input File : -
Require Hourly Printout : X
Perform Economic Analysis : -

Week/Weekend

Use different profiles for week and weekend: -

Swimmable Days

Use Swimmable Days Concept: -
Perform Comparative Run: -

WEATHER FILE

Weather File Name: C:\ENERPOOL\SAND.TMY

Format: Watsun TMY

Latitude: 32.73 degrees N

City Name: SANDIEGO CA

Time Base: Local Apparent (Solar) Time

SIMULATION DATA

Simulation Parameters:

Start Day of Simulation: January 1 (Julian day 1)

End Day of Simulation: December 31 (Julian day 365)
Number of Days in Simulation: 365
Require Printout of Simulation Parameters: X
Numerical Algorithms
Precision on Temperatures: 0.0001 C
Maximum number of iterations: 100

COLLECTOR TEST DATA

Collector Type: Unglazed
Collector Area: 4.64 m²
Test Flow Rate: 0.144 kg/s

Test Parameters:

A = 0.8104
B = 0.0395 s/m/C
C = 11.295 W/m²/C
D = 3.5746 J/m³/C
E = 0 W/m²

Incidence Angle Modifiers: Profile

Incidence Angle [degree]				
0	10	20	30	40
50	60	70	80	90
Incidence Angle Modifier []				
1	1	1	1	1
1	1	1	1	1

COLLECTOR USE DATA

Number of Collectors in Series: 1
Number of Series Groups in Parallel in a Bank: 8
Number of Banks of Collectors: 1
Collector Orientation
Slope: 20 degree
Azimuth: 0 degree
Controller
Delta T On : 1 C
Delta T Off: 0.5 C
Tmax Pool : 40 C
Pump
Pump Flow Rate: 3 kg/s
Pump Power: 750 W
Fraction of Pump Power Transferred to Fluid: 0.1
Wind Speed Correction Factor: 0.28
Wind Speed Threshold: 0
Collector sits on: Asphalt roof, insulated

PIPES DATA

Lengths

Inlet Pipe Length - Inside : 5 m
- Outside: 2 m
Outlet Pipe Length - Inside : 5 m
- Outside: 2 m
Insulation (per unit pipe length)
Heat Loss Coefficient Inside : 0.08 W/m/C
Heat Loss Coefficient Outside: 0.08 W/m/C
Temperature
Average Indoor/Soil Temperature: 10 C

POOL DESIGN DATA

Pool Type: Outdoor
Water Volume: 72.8 m³
Surface: 47 m²
Mains Water Temperature: 12 C
Fraction of Pool Above Ground: 0
Emissivity of Outside Walls Above Ground: 0.9
Absorptivity of Outside Walls Above Ground: 0.5
Insulation on Sides / Bottom: 5 m².C/W
Temperature Deep in Soil or in Mechanical Room: 10 C
Fraction of Pool Shaded from Sun: 0.25
Wind Speed Correction Factor: 0.14
Pool Model:

POOL USE DATA

Seasonal Use
Start Day of Season: January 1
End Day of Season : December 31
Temperature at Start of Simulation: 20 C

Pool Activity

Daily Spillage/Leakage: 0.1 m³
Hourly Pool Activity (weekday): 0 = none, 1 = moderate, 2 = high

1: 0	7: 0	13: 1	19: 0
2: 0	8: 0	14: 1	20: 0
3: 0	9: 0	15: 1	21: 0
4: 0	10: 0	16: 1	22: 0
5: 0	11: 0	17: 0	23: 0
6: 0	12: 0	18: 0	24: 0

POOL BLANKET DATA

Physical Properties
Short-Wave Absorptivity: 0.225
Short-Wave Transmissivity: 0.7
Long-Wave Emissivity: 0.29
Long-Wave Transmissivity: 0.55
Insulation value: 0.01
Fraction of Pool Area Covered: 0.95

Use

Blanket seasonal use (0=off, 1=on)

Jan: 1 Apr: 1 Jul: 1 Oct: 1
Feb: 1 May: 1 Aug: 1 Nov: 1
Mar: 1 Jun: 1 Sep: 1 Dec: 1
Daily Use = Always when pool not in use

AUXILIARY HEATER DATA

Auxiliary Heater Type: Gas or Oil

Temperature Setpoint: 30 C

Maximum Power (Input): 240000 W

Heater Efficiency: 70 %

Auxiliary heater seasonal use (0=off, 1=on)

Jan: 0 Apr: 0 Jul: 0 Oct: 0
Feb: 0 May: 0 Aug: 0 Nov: 0
Mar: 0 Jun: 0 Sep: 0 Dec: 0

Heater is off outside season of use of pool: -

HOURLY PRINTOUTS: ENERGIES

Passive Gain "QPass" [J] :-
Active Gain "QAct" [J] :-
Auxiliary Gain "QAux" [J] :-
Total Gain "QGain" [J] :-
Evaporative Losses "QEvap" [J] :-
Convective Losses "QConv" [J] :-
Conductive Losses "QCond" [J] :-
Radiative Losses "QRad" [J] :-
Side Losses "QSide" [J] :-
Spill and Makeup Losses "QMakeup" [J] :-
Total Losses "QLoss" [J] :-
Residual Energy Gain "QRes" [J] :-
Available Solar Energy "QInc" [J] :-
Solar Energy Collected "QColl" [J] :-
Energy Lost through Piping "QPipes" [J] :-
Energy Gain from Pumps "QPumps" [J] :-

HOURLY PRINTOUTS: POOL

Pool Temperature "TPool" [C] : X
Mains Temperature "TMains" [C] :-
Makeup Water "MdotMakeup"[kg/s]: -
Soil Temperature around Pool "TSoilPool" [C] :-

HOURLY PRINTOUTS: WEATHER

Global Horizontal Irradiance "HGlo" [W/m2]: -
Ambient Dry Bulb Temperature "TAmb" [C] : X

Ambient Relative Humidity "RelHum" [0-1] : -
Ambient Wind Speed "VWind" [m/s] : -
Pool Direct Horizontal Irradiance "HDirPool" [W/m2]: -
Pool Diffuse Horizontal Irradiance "HDifPool" [W/m2]: -
Pool Dry Bulb Temperature "TAmbPool" [C] : -
Pool Relative Humidity "RelHumPool"[0-1] : -
Pool Wind Speed "VWindPool" [m/s] : -
Sky Temperature "TSky" [C] : -

HOURLY PRINTOUTS: COLLECTORS/PIPES/HEAT EXCHANGER

Collector Inlet Temperature "Tci" [C] : -
Collector Outlet/Plate Temperature "Tco" [C] : -
Collector Flow Rate "MdotColl" [kg/s]: -
Inlet Pipe Input Temperature "TPipeIn" [C] : -
Outlet Pipe Output Temperature "TPipeOut" [C] : -
Temperature of Soil around Pipes "TSoilPipe" [C] : -
Exch. Temperature Out, Cold Side "TXColdOut" [C] : -
Exch. Temperature Out, Hot Side "TXHotOut" [C] : -
Exch. Flow Rate "MdotExch" [kg/s]: -

HOURLY PRINTOUTS: CONTROLS

Activity Level in Pool "Activity" [0-2] : -
Blanket On "BlanketOn" [0/1] : -
Collector On "CollOn" [0/1] : -
Auxiliary Heater On "AuxOn" [0/1] : -