POOLHEAT 5.10

SWIMMING POOL HEAT LOAD ANALYSIS AND HEATER SIZING

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POOLHEAT LICENSE CONDITIONS

The POOLHEAT license covers installation by the licensee at one site only.

By installing this software you acknowledge that Thermal Design assumes no responsibility or liability for the accuracy of the program or for the results which may arise from its use.

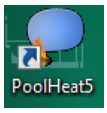
SOFTWARE INSTALLATION

Installation is a three step process

1. Run the program *setup.exe*
2. Copy the file *license.dat* to the **POOLHEAT** installation directory.
3. Copy the weather data files **.TMY* to the **POOLHEAT** installation directory.

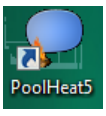
SETUP PROCEDURE TO INSTALL A DESK TOP ICON FOR POOLHEAT

Press the right mouse button when pointing at the windows desk top
select new
select shortcut
select browse
locate the file *POOLHEAT.NET.EXE*
select open

An icon 

will be placed on the windows desk top

TO START POOLHEAT

Click on the POOLHEAT windows icon 

or use the Windows explorer to find and run POOLHEAT.NET.EXE in the directory you selected during installation.

NOTE: When running under Vista or Windows7 the windows feature “User account control” must be turned off. It may also be necessary to set Poolheat to run as administrator – see separate instructions.

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INTRODUCTION

This document outlines the operation of the **POOLHEAT** simulation program for evaluating the performance of swimming pool heating systems.

POOLHEAT is a thermal analysis package for evaluating temperatures and energy flows in indoor and outdoor swimming pools. Operating characteristics can be determined for pools with the following heating systems

- Unheated outdoor pool.
- Gas heating.
- Heat pump heating.
- Solar collector heating.
- Solar collector heating with gas or heat pump backup.

The thermal analysis is based on procedures defined in

Australian Standard AS3634 "Solar Heating Systems for Swimming Pools"

and

International Standards Organisation report TR12596 "Solar heating - Swimming pool heating systems - Dimensions, design and installation guidelines"

POOLHEAT output includes monthly summaries of water temperatures (minimum, average and maximum) and the following energy flows

- Direct solar heating of outdoor pools, with allowance for shading, local wind conditions and pool covers.
- Modes of heat loss (evaporation, convection, radiation, make-up water heating and back flushing).
- Heating system input.
- Air heating load for indoor pools.
- Humidity conditions in the pool enclosure.

PROGRAM FEATURES

- Heating system analysis for gas, heat pump and solar heat source.
- Weather data for a large number of locations.
- Pool design features.
- Effect of number of users on heat loss due to evaporation.
- Sizing of heating system to meet required temperature specifications.
- Minimum and maximum pool temperatures for a specified heating system capacity.
- Effect of pool covers for both indoor and outdoor pools.
- Ventilation analysis of pool building for indoor pools.
- Solar collector efficiency characteristics of a specific solar collector or use one of 32 collector and roof types defined in the program.

Outdoor pools

Pool shading.

Exposure to wind.

Pool cover.

Over temperature control.

Heater capacity required for a specified operating temperature or for a specified heating system capacity.

Indoor pools

Monthly pool heating requirements.

Pool cover.

Ventilation analysis of pool building.

Temperature and humidity levels in the pool building.

Space heating requirements.

Solar collector heating

Collector efficiency data for 32 collector/roof combinations or user defined solar collector efficiency.

Solar collector types include plastic extrusions, flat plate and evacuated tube collectors.

WEATHER DATA LOCATIONS

POOLHEAT uses hourly records of solar radiation, ambient temperature, ambient humidity and wind speed. Available locations include :

Amberley	Queensland		Melbourne	Victoria
Brisbane			Mildura	
Cairns			Sale	
Longreach			Hobart	Tasmania
Mt Isa			Launceston	
Oakey Army			Adelaide	South Australia
Rockhampton			Mt Gambier	
Townsville			Oodnadatta	
Broken Hill	New South Wales		Woomera	
Cobar			Darwin	Northern Territory
Coffs Harbour			Alice Springs	
Lightning Ridge			Albany	Western Australia
Moree			Broome	
Nowra			Carnarvon	
Orange			Corrigen	
Richmond			Forrest	
Sydney			Geraldton	
Tamworth			Hall's Creek	
Wagga Wagga			Kalgoorlie	
Williamtown			Perth	
Canberra	ACT		Port Hedland	

New Zealand
Auckland
Alexandra
Christchurch
New Plymouth
Wellington

China
Beijing
Chengdu
Guangzho
Kunming
Shanghai
Wuhan
Xiamen

Europe

Lisbon	Portugal
Madrid	Spain
Marseille	France
Paris	France

Middle East

Abu Dhabi	United Arab Emirates
Dubai	United Arab Emirates

Indonesia

Bandung	Java

Data files for locations not listed in the above table can be generated for locations for which meteorological data is available. Contact Thermal Design at t_design@tpg.com.au for additional weather data.

PROGRAM OPERATION OVERVIEW

The **program input screens** are selected by clicking on the menu items along the top of the screen. Numerical values can be changed by over-typing after selecting the item with the mouse. Select options from lists by pointing with the mouse and pressing the left mouse button.
To save the input data to a specified file name, select **File - Save** before you run a simulation. The results will be saved to a file with the name specified in the save operation, with file type .RES. If the **File - Save** option is not used the input data and results will be saved in file names DEFAULT.DAT and DEFAULT.RES.
The program calculates pool heat loss and heating system inputs using a small time step thermal simulation model.

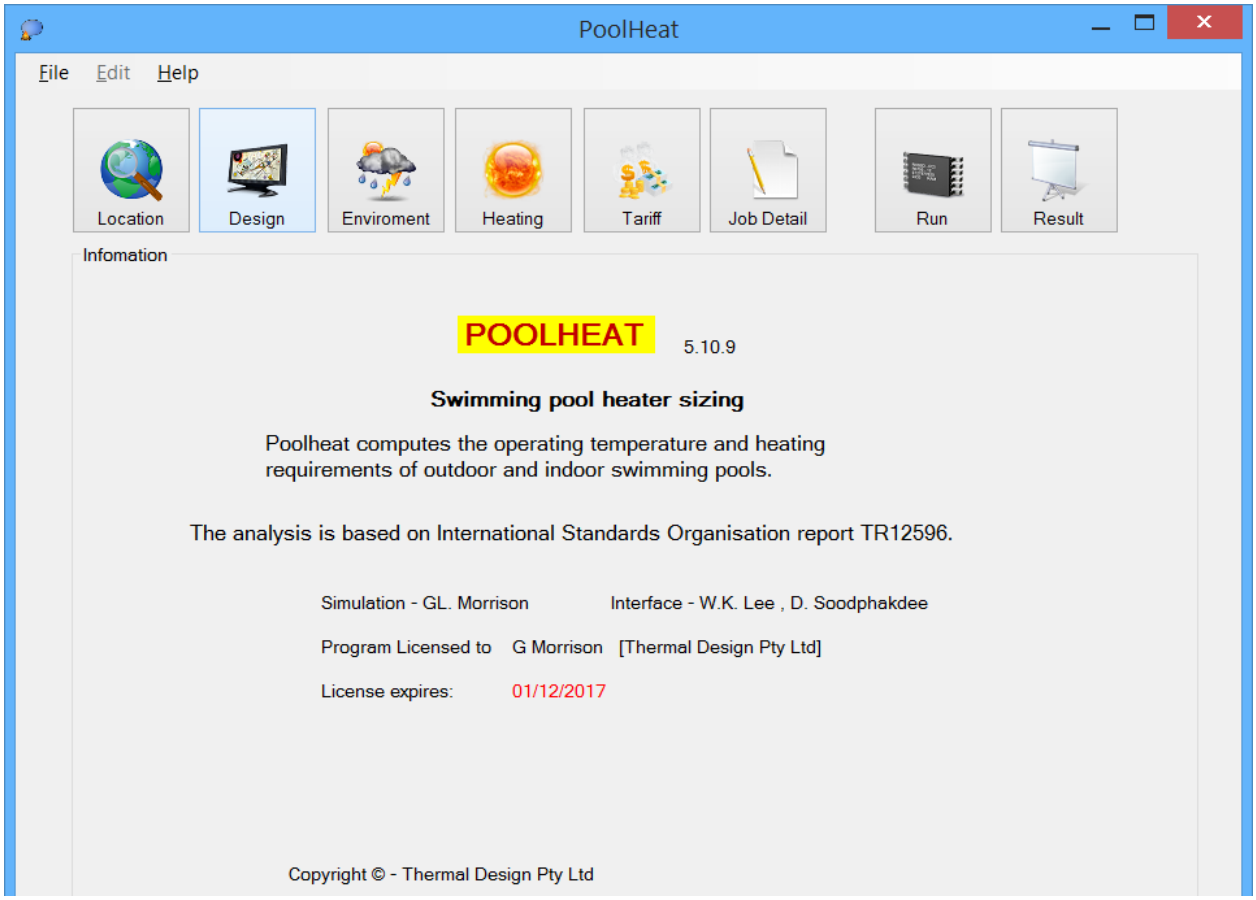
After an annual performance calculation has been completed the results can be viewed by selecting **Result** from the top menu bar. The pool temperature and purchased energy use can be selected from the tabs on the result window. The full results are displayed in a text result file that may be viewed and printed by selecting the Result Summary tab in the result window. The result file is in standard text format and may be read into a word processor document (use Courier font so that table items line up) or viewed out of POOLHEAT by using Notepad.
A comma separated variable result file is also produced; this data can be copied into EXCEL templates supplied with POOLHEAT (different templates for indoor and outdoor result files). The templates have prepared graphs of pool temperatures, energy flows and indoor space conditions etc throughout the year.

ANALYSIS

The analysis in **POOLHEAT** follows the procedures specified in Australian Standard AS3634 and International Standards Organisation report TR12596. As a large number of alternative design, operating conditions and usage levels may be specified the applicability of a given result rests with the user. *By installing this software the licensed user acknowledges that Thermal Design assumes no responsibility or liability for the accuracy of the program or for the results which may arise from its use.*

PROGRAM OPERATION

The startup screen is shown below



FILE : The default file name is DEFAULT, results are saved to the file DEFAULT.RES unless the input data has been saved to a new file name before the **Run** command is selected.

DATA ENTRY PROCEDURE

For a new evaluation the sequence of operations would be

- select the location by selecting the menu item 

- enter parameters using the Design, Environment, Heating and Tariff screens.
- save the input data using the **File - Save** operation.
- select **Run**. (results will be written to the file name specified in the **File - Save** operation).

The data entry procedure for modifying a previously saved case would be

- use the **File - Open** operation to load the previous data file
- edit the parameters using the Location, Design, Environment, Heating and Tariff screens.
- save the new data using the **File - Save** operation and enter a new file name.
- select **Run**. (results will be written to the file name specified in the **File - Save** operation).

FILE NAME

The current file name is displayed under the **File** button

INDOOR/OUTDOOR POOLS

The parameters for indoor or outdoor swimming pools are selected in the Environment window. The Environment window changes for indoor or outdoor.

RESULTS

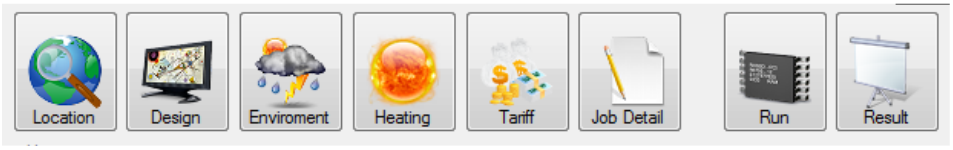
Selecting the **Results** button on the top menu bar will display the results file, the full results record may be printed by selecting the print button at the top right of the result screen. The result file may also be read into a word processor document (use Courier font to line up table columns).

RUN

Selecting the **Run** button on the top menu bar will start the annual performance evalaution. The run time is typically less than 1 minute for an outdoor pool and longer for an indoor pool depending on the computer speed. The simulation progress is displayed during the analysis.

SELECTING FORMS

There are eight forms for defining the swimming pool and heating systems configuration.



Location – selection of weather data

Design - swimming pool parameters

Environment - swimming pool operating environment

Heating -(solar, gas or heat pump or combinations

Tariff - electricity and gas supply tariffs and costs

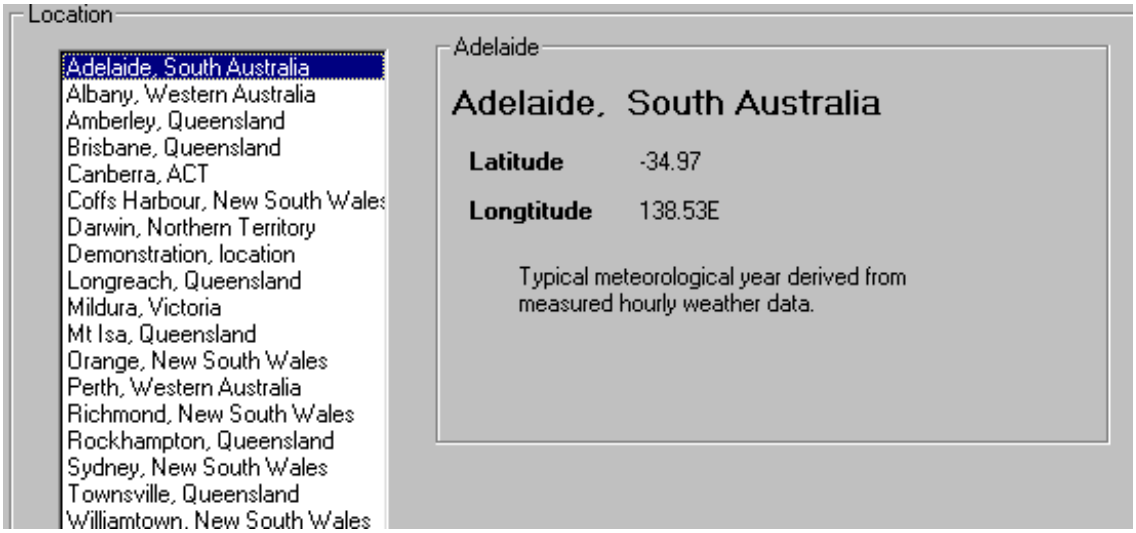
Job Details - record of customer information and job notes

Run – start calculation of annual performance

Result – view the result pages and print the result summary file.

LOCATION

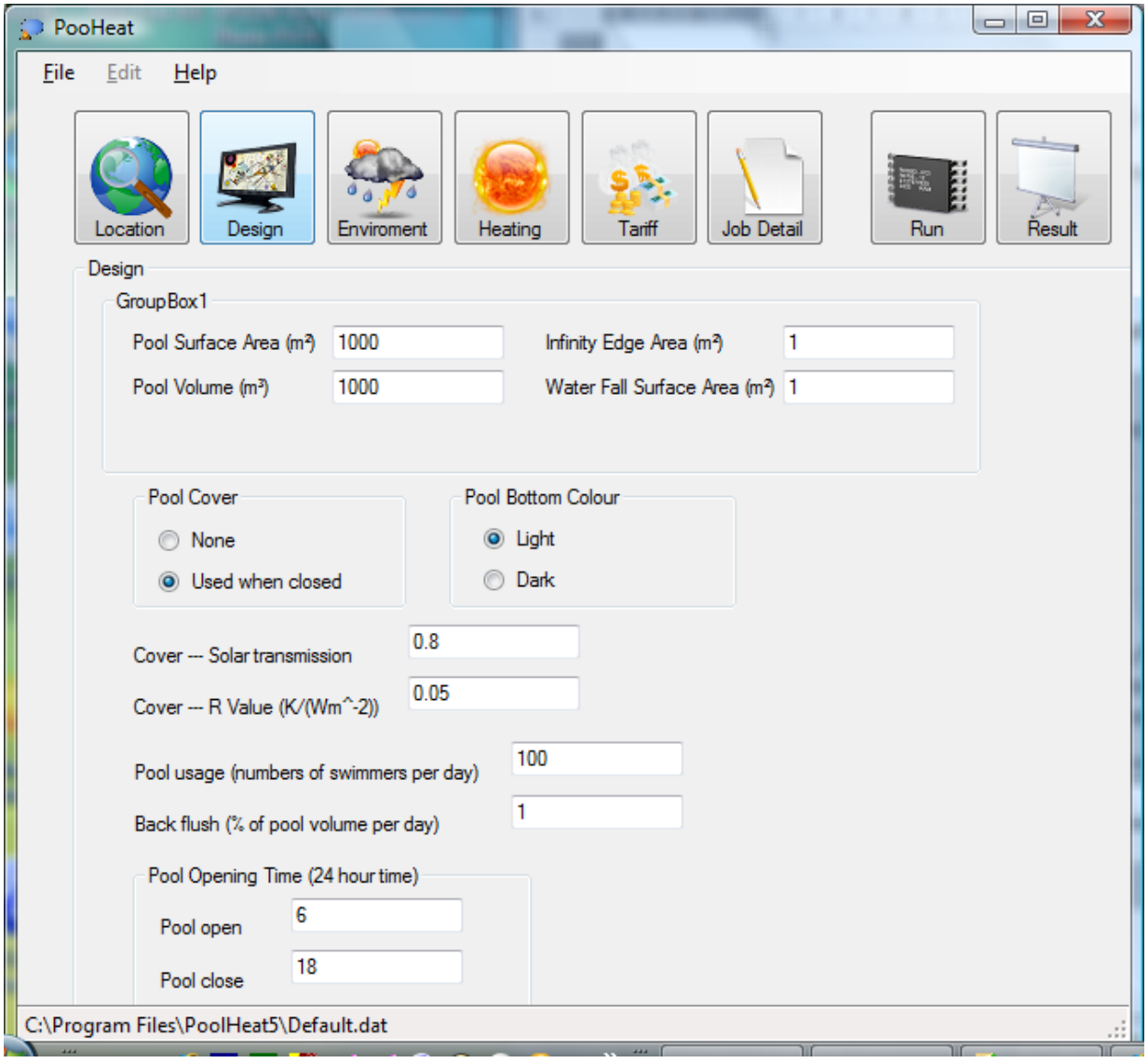
The location screen lists the weather data files in the working directory. Select the location from the list by pointing with the mouse or use the up/down arrow keys.



The particular locations listed will depend on the weather data files that have been included with your version of POOLHEAT. Additional weather data files can be obtained from Thermal Design.

DESIGN

The design screen is used for describing the pool size and operating features.



Infinity edge area

The infinity edge area is the surface area of water over a shallow edge of the pool.

Water fall surface area

The water fall surface area refers to a water fall or pool feature over which water is flowing. The area is the water surface area exposed to the atmosphere, for a free falling water fall the surface

area is the sum of the front and back areas. For water flowing down a slide etc the surface area would be the top area only.

Cover
If a cover is specified it is assumed to be fitted when the pool is closed.

Pool Usage
The number of swimmers in the pool each day is used to compute the water evaporation as a function of pool use.

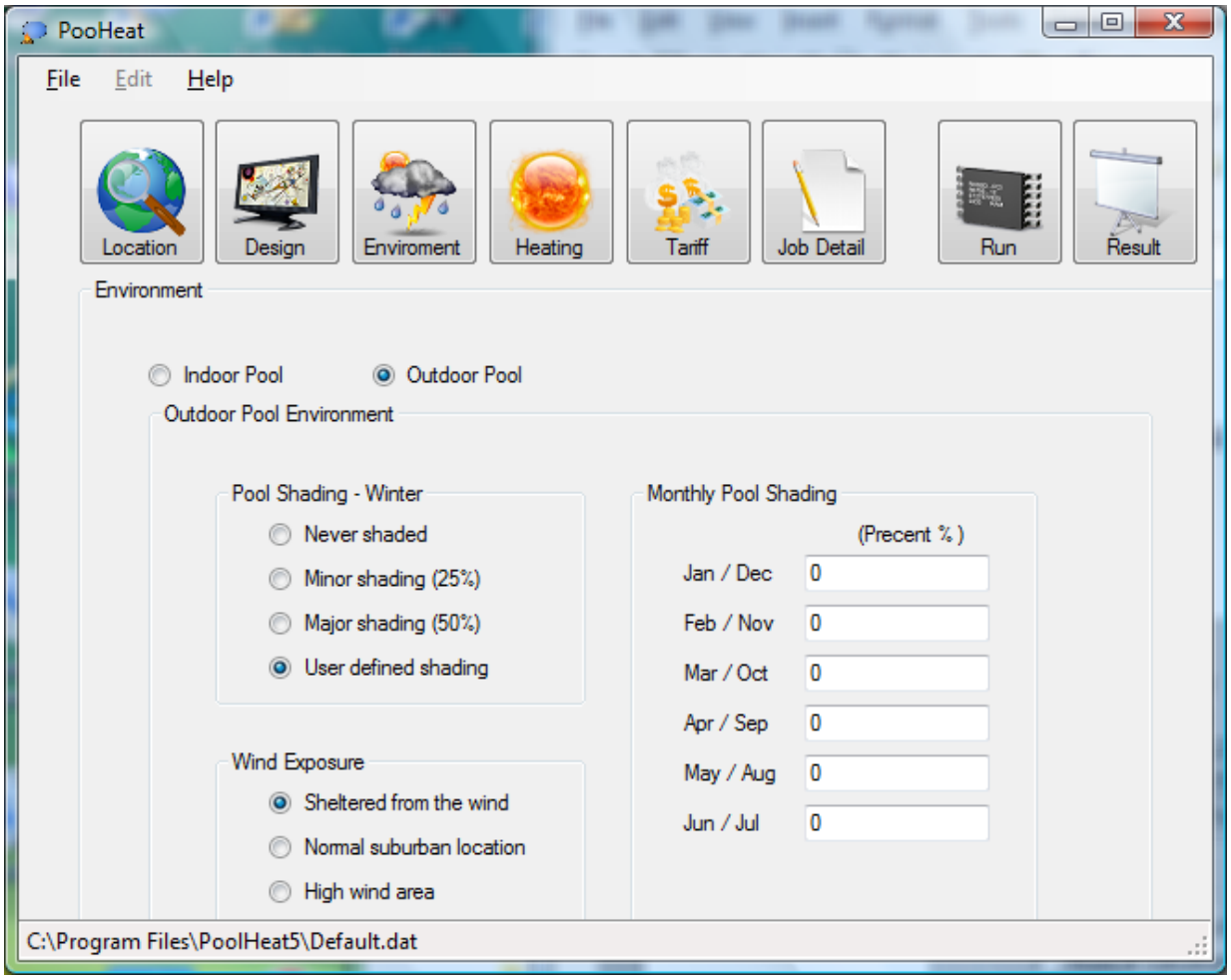
NOTE: The level of usage of a pool can have a significant effect on the evaporation heat loss. If the size of a pool is changed the **Pool Usage** input should also be changed.

Flushing and evaporation make-up
The pool energy balance includes the effect of the addition of mains water to compensate for evaporation and filter flushing. The temperature of mains water is included in the weather data file where it is known (ref 1). If the mains water temperature is not known for the location selected it is taken as the average air temperature in the previous month.

ENVIRONMENT

The environment screen is used for setting the conditions in which the pool is operating.

Outdoor environment



Shading

Specify typical shading of the pool water surface due to surrounding buildings or trees in winter, or select

User defined shading to specify month by month shading levels

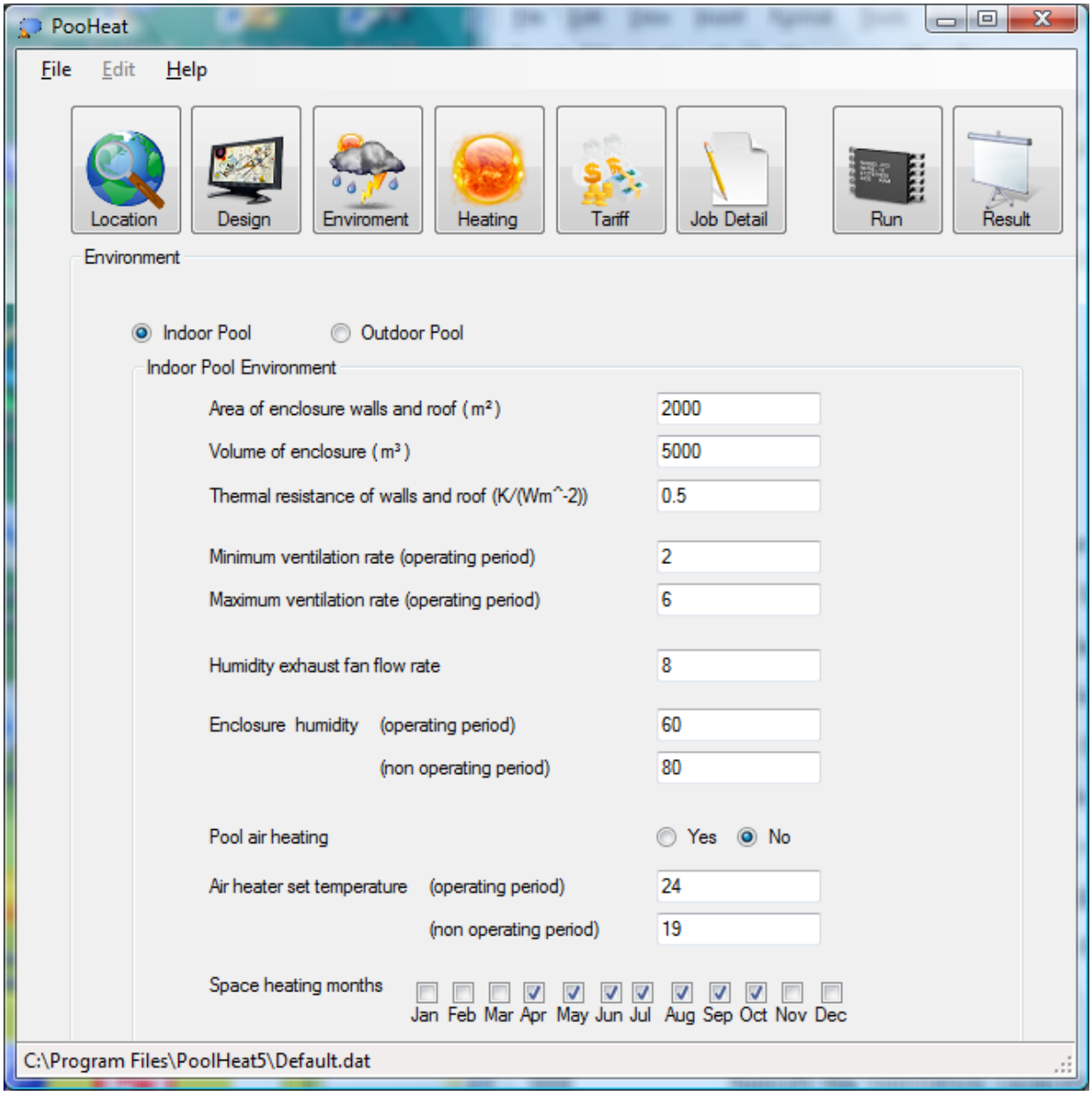
In the monthly shade specification box enter 100 for full shade and 0 for no shade on the pool during the middle 6 hours of the day in winter and middle 8 hours of the day in summer.

Wind exposure

Specify the typical ground level wind condition for an outdoor pool as either

- Sheltered location, ie wind breaks fitted around the pool.
- Open position.
- Exposed windy location.

Indoor environment



Ventilation

Specify the minimum day time ventilation rate of the pool space, in air changes per hour. A minimum of 2 air changes per hour would be required for comfort. Also specify the maximum day time ventilation rate of the pool space in air changes per hour. The ventilation rate is varied during the operating period in order to maintain the specified day time humidity level.

If the indoor humidity level is less than the set point humidity the minimum ventilation rate is used. If the indoor humidity is higher than the set point the ventilation flow rate is increased (up to the specified maximum) until the set point humidity is achieved. If the outside humidity is higher than the indoor humidity set point the maximum air flow rate is used.

Outside of the operating hours the ventilation fans are turned off.

Exhaust fan

Specify the ventilation capacity of the exhaust fan in air changes per hour. The exhaust fan is assumed to operate when the indoor humidity exceeds the humidity set point.

At night the humidity exhaust fans are turned off if the indoor humidity is less that the night time humidity set point. If evaporation from the pool causes the indoor humidity to rise above the night time set point, the humidity exhaust fans are turned on (ventilation fans remain off).

Humidity

Specify the desired humidity of the pool enclosure during pool opening hours. If the outside humidity and restrictions on ventilation rates do not allow this value to be maintained then the program computes the actual inside humidity condition.

Specify the desired humidity of the pool enclosure outside of pool opening hours. This value should be high to minimise night time heat loss from the pool however, condensation on the walls must be considered when a high value is specified.

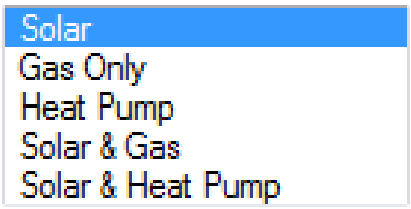
Air Heating

Specify if the fresh air to the pool enclosure is heated. If heating is used specify the set temperature of the air heating system. If night time air heating is not required specify a low night time set temperature.

Air heating is supplied by the same heat source as for pool water heating.

HEATING SYSTEM

The heating system screen contains a series of menus for specifying the heating system parameters. A menu of types of heating systems can be selected from a pull down menu in the top right corner of the heating system screen (click on the down arrow).



The primary heating screen changes in response to the type of heating system selected.

If multiple heating systems are specified (eg solar and gas) there are two heating system screens, the toggle between the two screens will appear at the top of each of the screens.

The solar heating input has three levels of input menus, the solar collector efficiency can be specified in terms of measured performance (ref 4) or a specific solar collector type and roof system may be selected from a built in list of 32 types of solar heating systems (ref 3).

Heating system capacity analysis

The heat pump or gas heater capacity may be specified or the program used to compute the capacity required to meet the design temperature specification. If the capacity is not specified the program will list the average capacity over the month required on the basis of 24hr operating time (or maximum possible operating time if the start and stop times are specified).
If the minimum pool temperature is critical then the effect of specifying the listed capacity can be checked by entering it as the specified capacity and running the analysis again to determine the minimum temperature during each month for this capacity.

Solar collector efficiency

A solar collector may be selected from the 32 collector-roof configurations built in to the program or test results for particular collector-roof systems may be specified. The built in configurations are selected from two lists, the first list, **solar collector type,** allows selection from a range of collector types, the second list allows selection from a range of collector-roof configurations and more detailed collector construction details.

As the solar collector-roof configuration selection is changed the coefficients in the collector efficiency equation are shown on the screen. To specify the characteristics of a new solar collector, test data for the thermal performance must be available in the form

$$\text{Efficiency} = a - (b + c*U)(T_w - T_a)/G_n$$

where a,b and c are coefficients evaluated from the test data.

U is wind speed (m/s)

G_n is the incident solar radiation (short wave and long wave) (W/m^2)

T_w & T_a are the pool water temperature and ambient temperatures (°C)

Incidence angle modifier

Flat plate solar collectors

The incidence angle modifier $K_{\tau\alpha}$ is used to compute reflection from the solar collector surface

$$K_{\tau\alpha} = 1 - d\,(1/\cos(\theta) - 1)$$

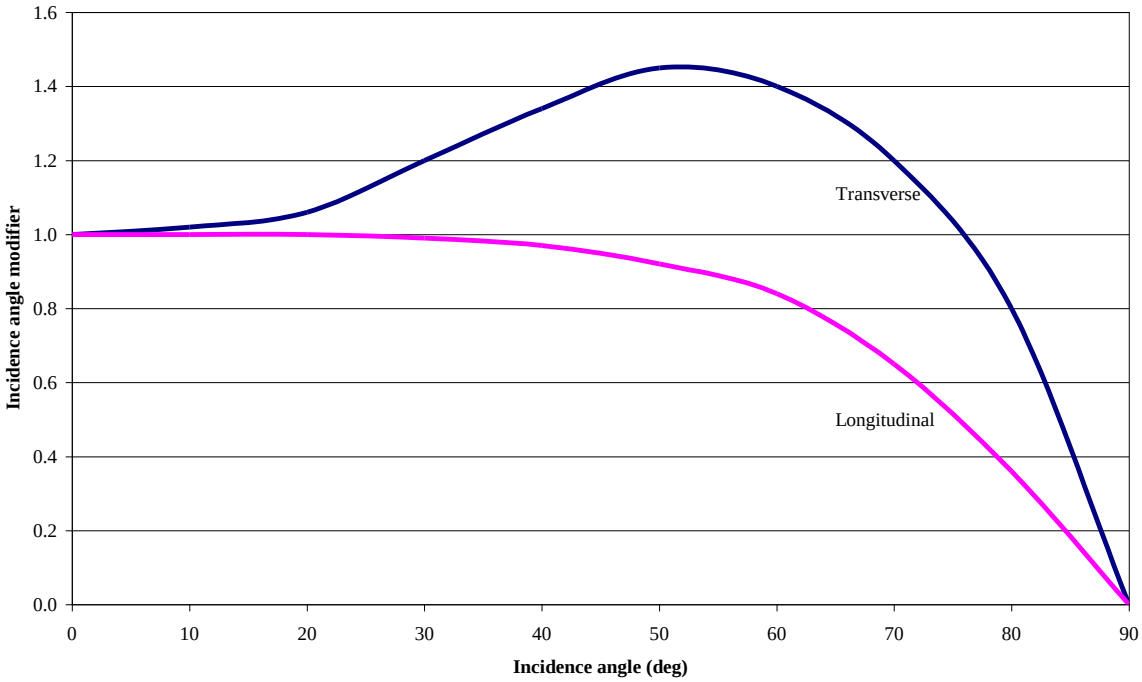
where d = incidence angle coefficient (to be specified)

θ = incident angle (computed in the program)

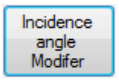
The measurement procedure to determine the performance of an unglazed solar collector is given in reference 4.

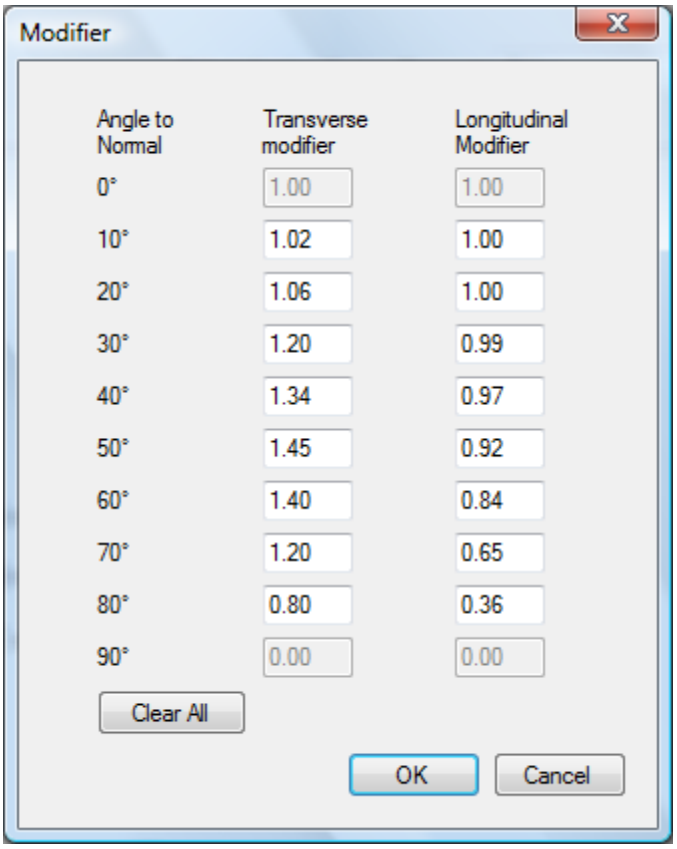
Evacuated tube solar collectors

The incidence angle modifier for evacuated tube solar collector is taken as the product of the transverse and longitudinal modifiers. Typical modifiers are shown below.



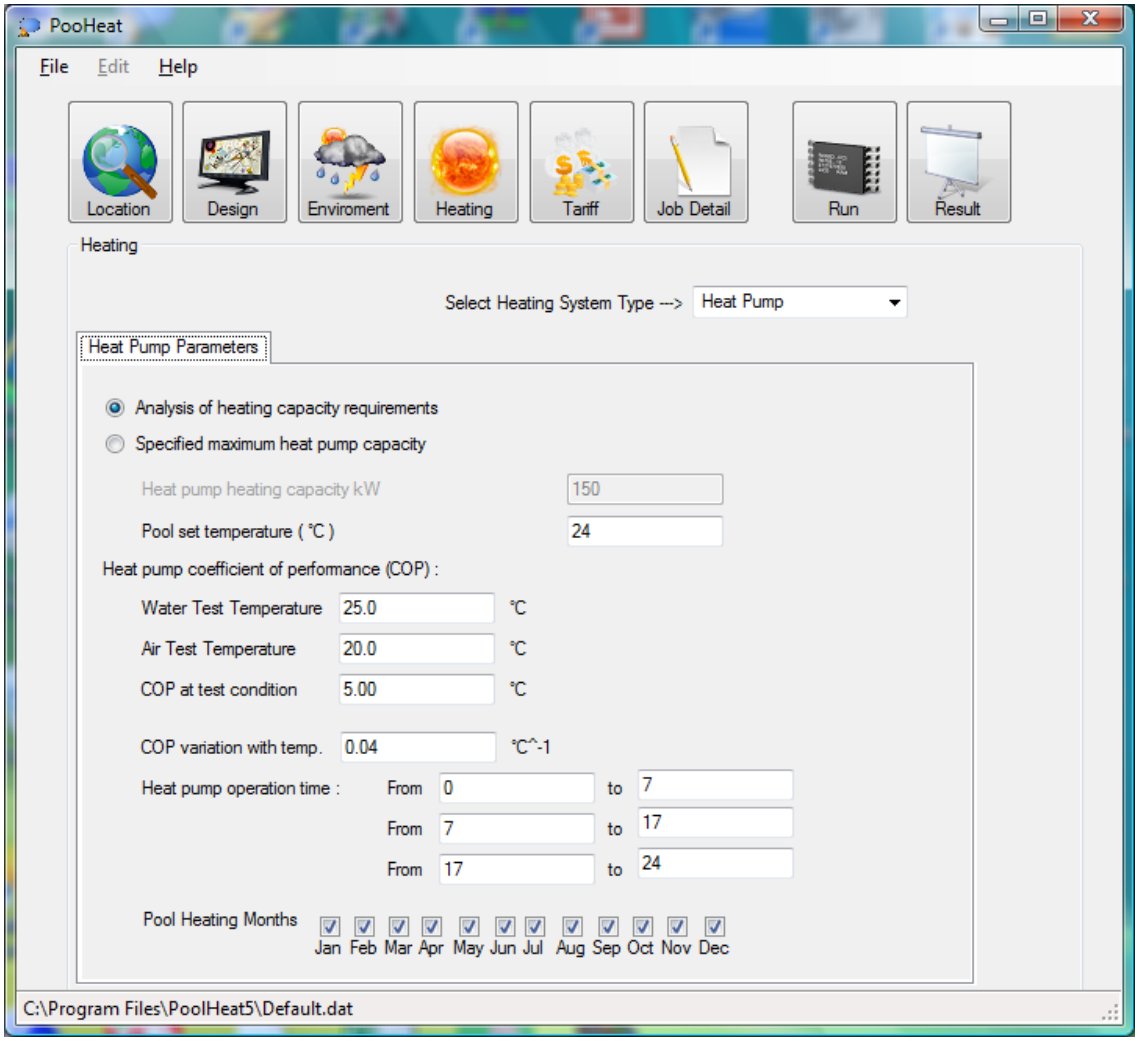
For a user specified evacuated tube solar collector the transverse and longitudinal incidence angle modifier test data is entered into POOLHEAT via the following table selected by clicking on the Incidence Angle Modifier tab .





Heat pump specification

The **heat pump** specification screen is



The heat pump performance is based on measured performance at a specified test condition (water temperature and air temperature) and the variation (*b*) of the COP with the temperature difference between the air and water temperature.

$$COP = a - b*(T_w - T_a)$$

The test data is entered in POOLHEAT by specifying

- water test temperature (typically 25C)
- air test temperature (typically 20C)
- COP determined from performance measurements at test water and air temperatures
- the variation of COP with temperature difference as specified by coefficient "*b*".

During the annual performance analysis POOLHEAT determines *COP* at water and air temperatures T_w and T_a as follows

$$COP = COP_{test} - b * \left[(T_w - T_a) - (T_w - T_a)_{test} \right]$$

where

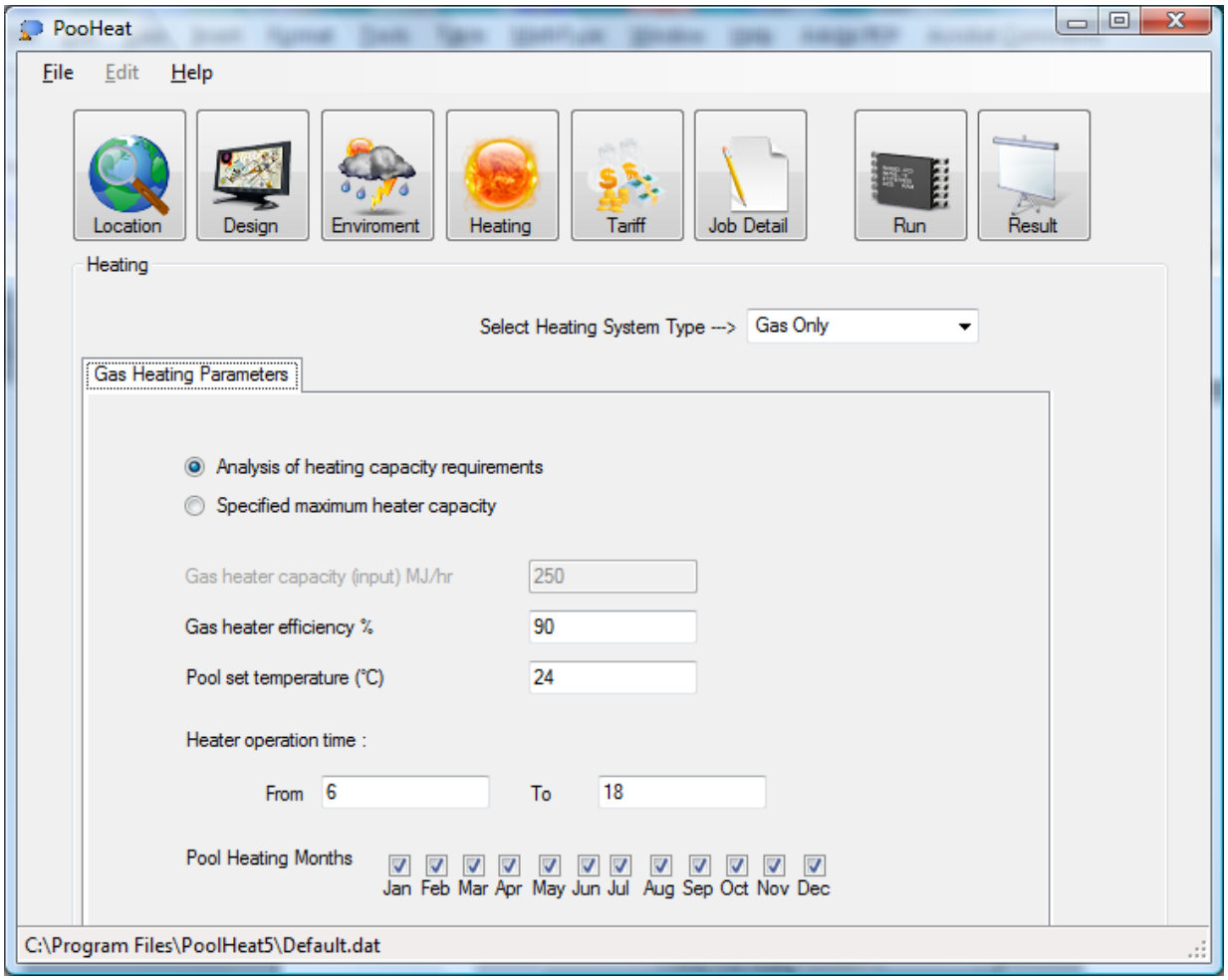
COP = operational *COP* at water temperature T_w and air temperature T_a.

COP_{test} = *COP* at test conditions $(T_w - T_a)_{test}$

b = variation of *COP* with temperature difference (typical value = 0.05 C^{-1})

Gas heater specification

The **gas heater** specification screen is

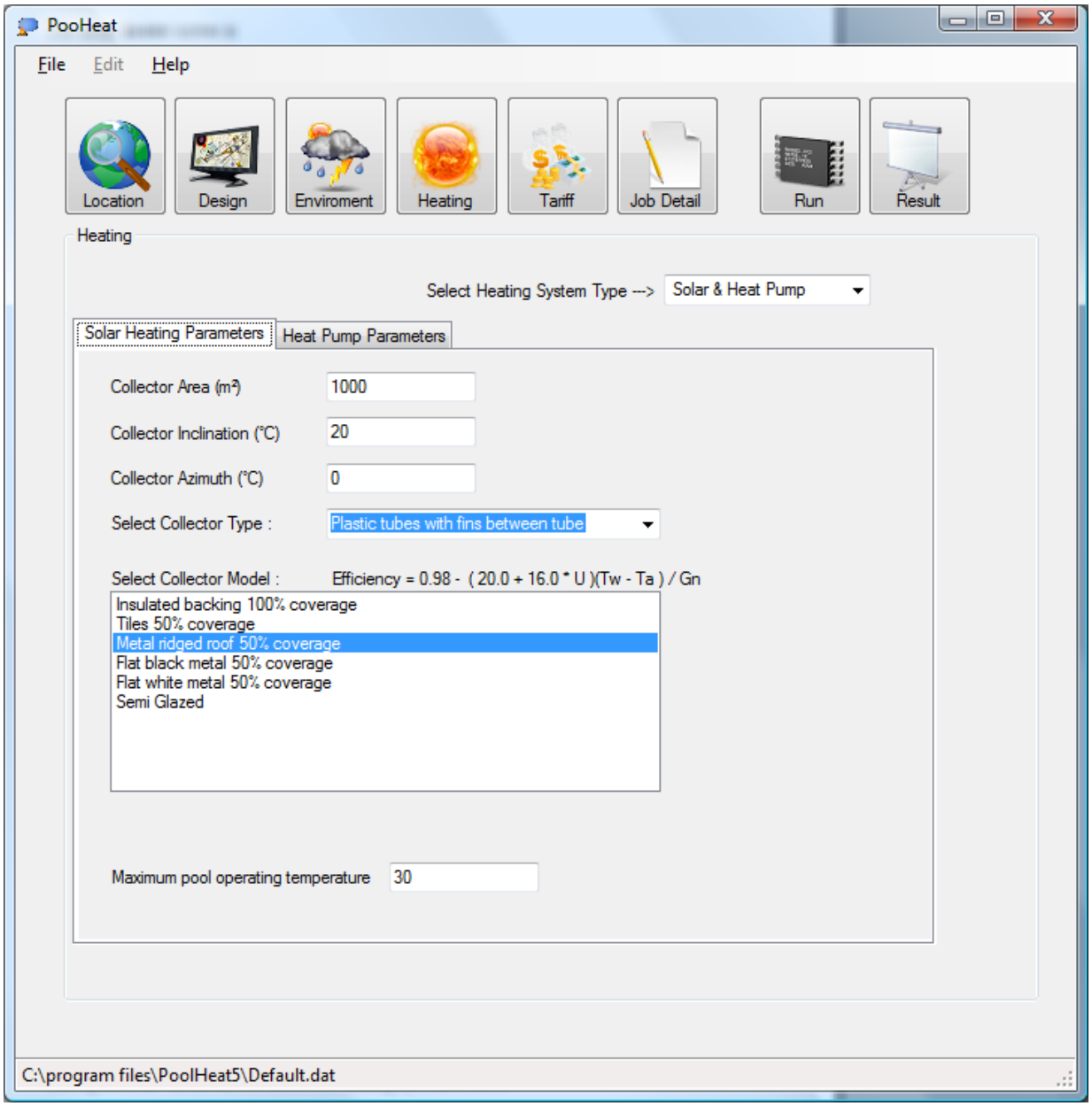


If the gas capacity is not specified (see above) then the program determines the minimum capacity required to meet the specified operating temperature.

If the gas capacity is specified then the system may not satisfy the specified pool temperature.

Solar heater specification

The **solar heater** screen is



Solar collector area

For the default collector efficiencies in PoolHeat the Collector Area is the aperture area of the collector. For a collector consisting of parallel strips of absorber tubing, mounted on the roof with spacing between the parallel strips, the aperture area is the area of the strips only. For the default evacuated tube solar collector the aperture area is the cross sectional area of the tubes (the outer glass envelope).

If user tested collector efficiency coefficients are entered into PoolHeat then the collector area is the area used by the test laboratory to calculate collector efficiency; the solar collector efficiency

coefficients depend on whether gross area, aperture area of absorber area was used by the test laboratory in determining the efficiency coefficients.

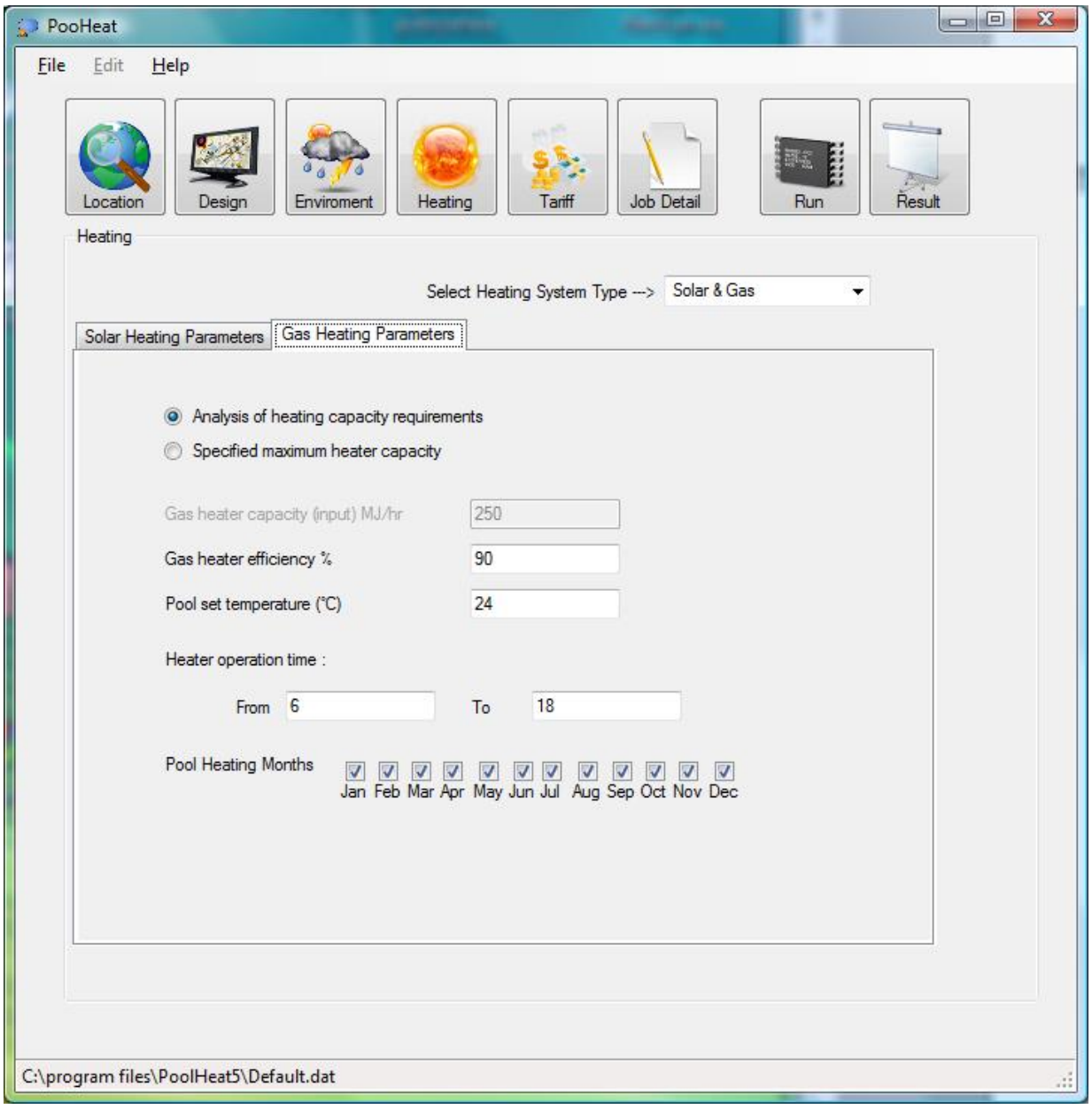
Azimuth angle (180° to -180°) is the horizontal angle from the north/south line to the direction the solar collector is facing. The azimuth is zero for a collector facing the equator and is positive for a collector facing towards east.

The % coverage specification for some of the Collector Models refers to the % of the section of roof covered by the absorber. An unglazed collector absorber receives direct solar input and heat input from adjacent sections of the base roofing material.

This screen also has a toggle control at the top for switching between solar and heat pump heating screens for a dual heating system.

Pool heating season

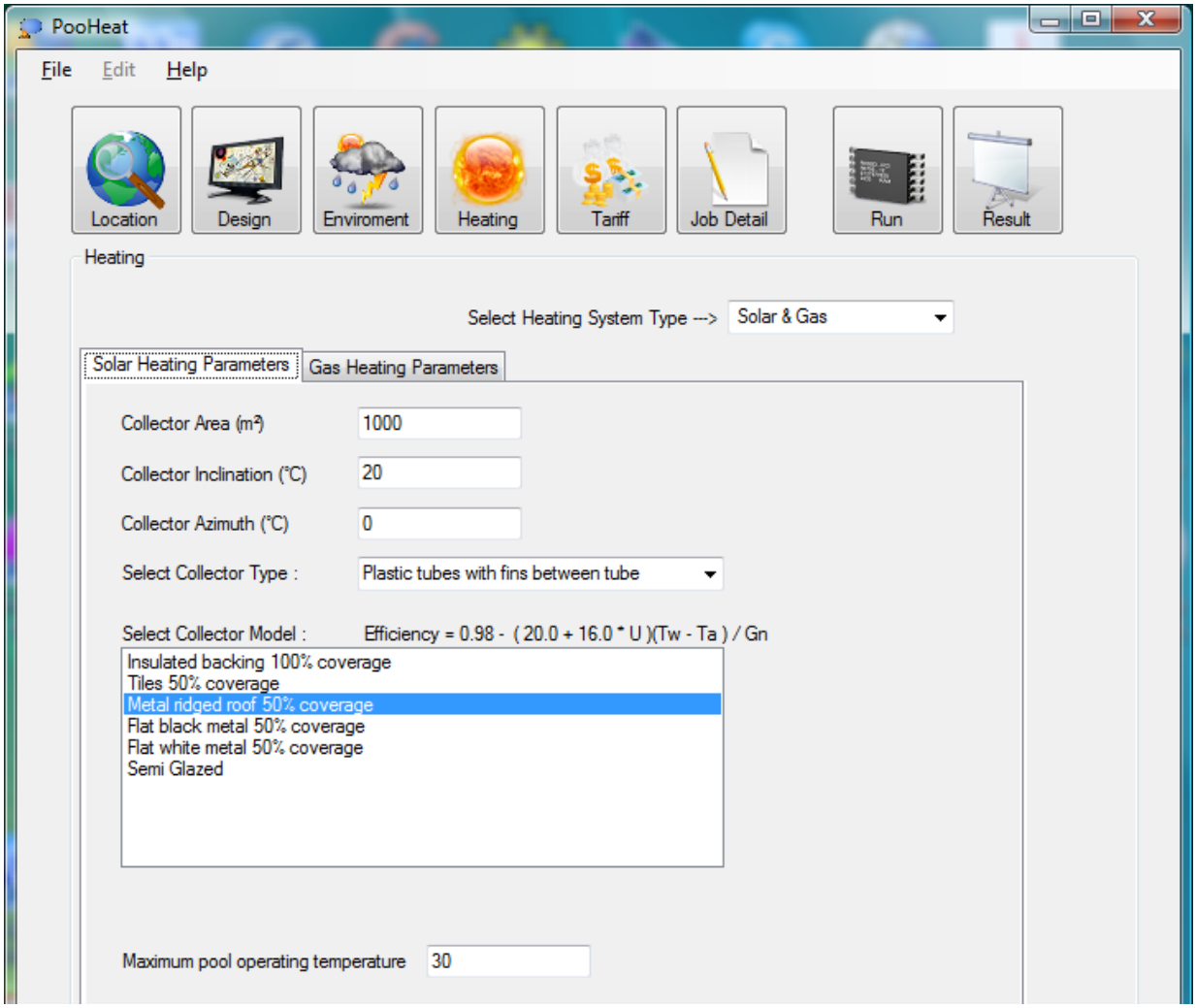
The operating months of the gas or heat pump heating systems can be specified in the "Pool heating months" list at the bottom of the gas and heat pump heating system screens.



For the months that the gas or heat pump heating is turned off the solar collector is also assumed to be turned off.

The **solar plus gas heating** specification screen is

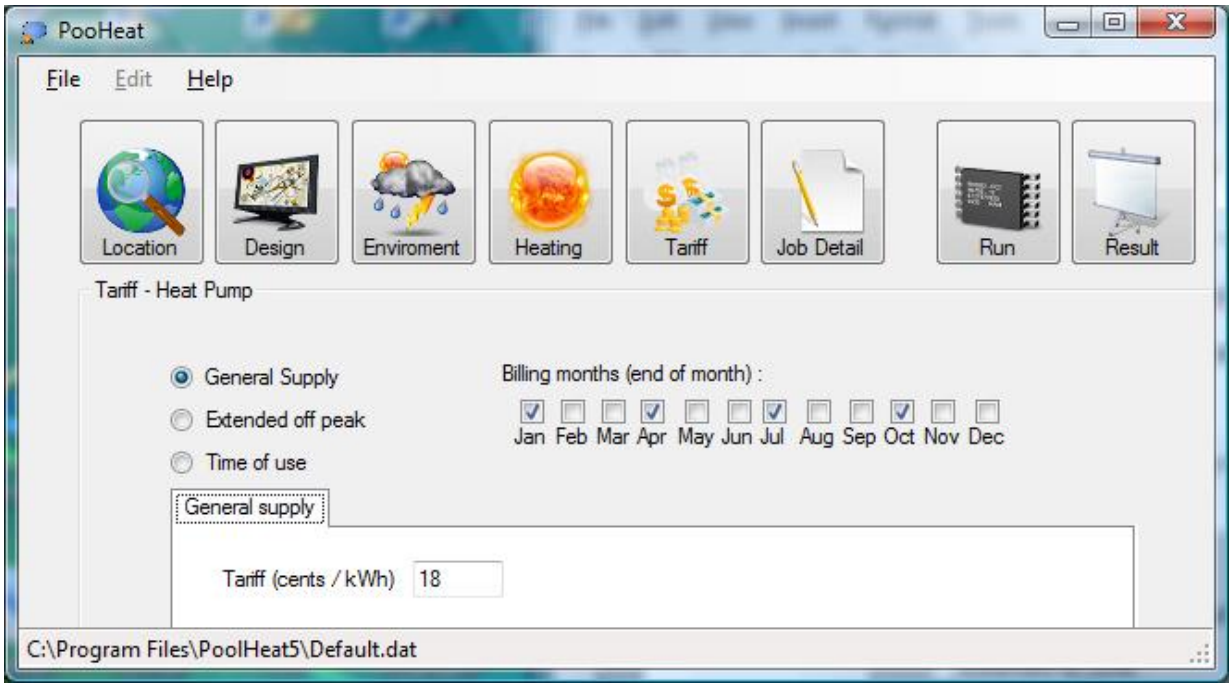
This screen has menus at the top for switching between solar and gas heating screens for a dual heating system.



Gas and electricity tariffs

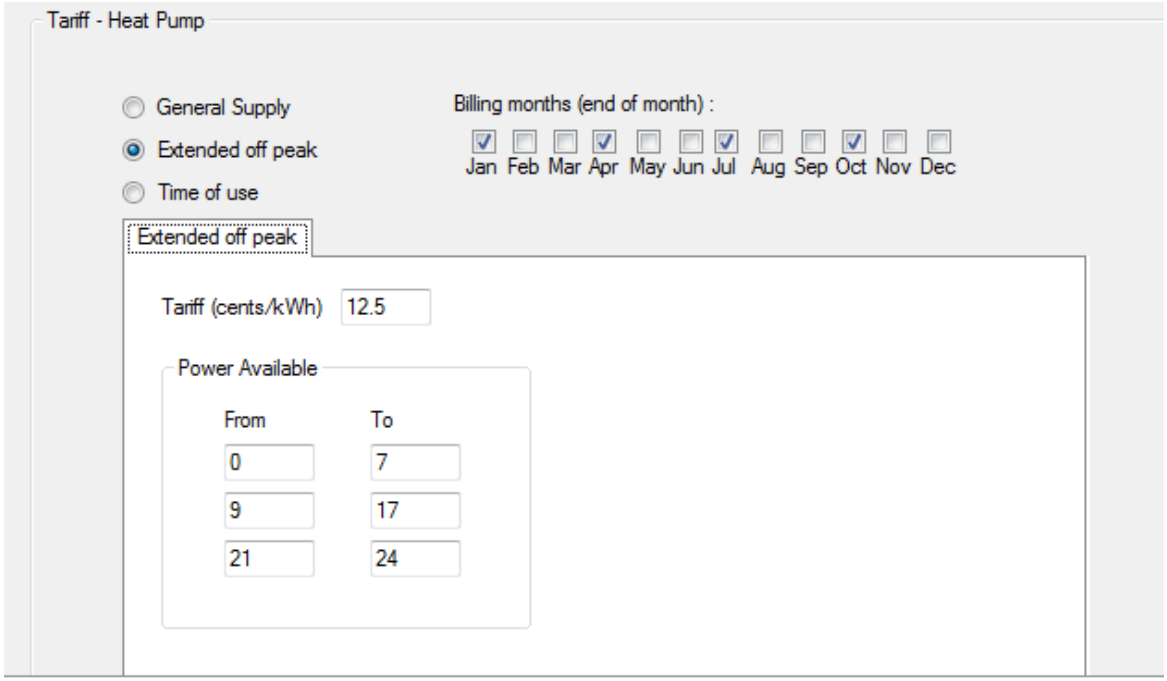
The gas or electricity tariff screen contains a series of forms for specifying the electricity and/or gas tariff times and costs. There are three electric tariff screens corresponding to different tariff supply options, the screen for extended offpeak operation is shown below. For some tariffs there are secondary menus for detailed tariff availability times.

The **general supply electricity tariff** screen is

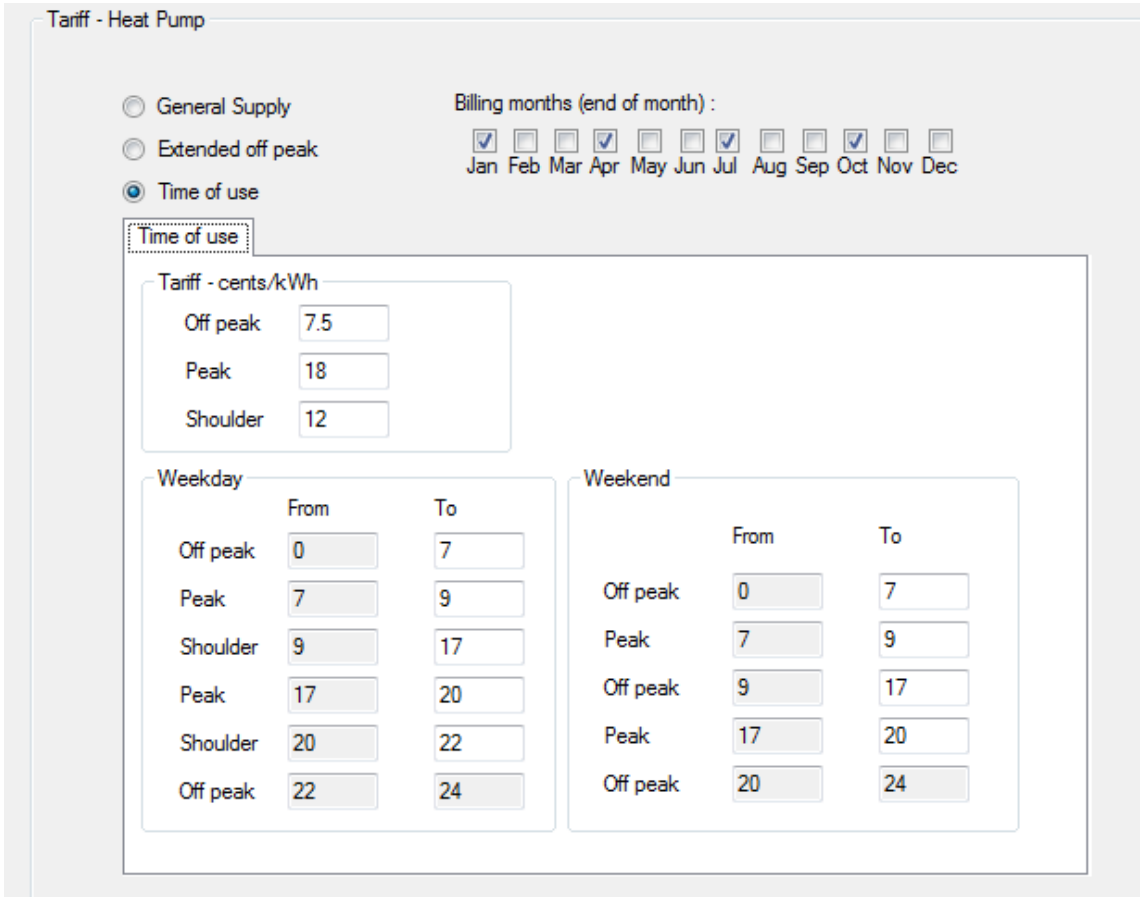


NOTE: The operating cost is only reported in the Result Summary output for selected "Billing months" (multiple months operating cost accumulated over billing periods). If you need the operating cost to be reported for each month then select ALL MONTHS for the "Billing months".

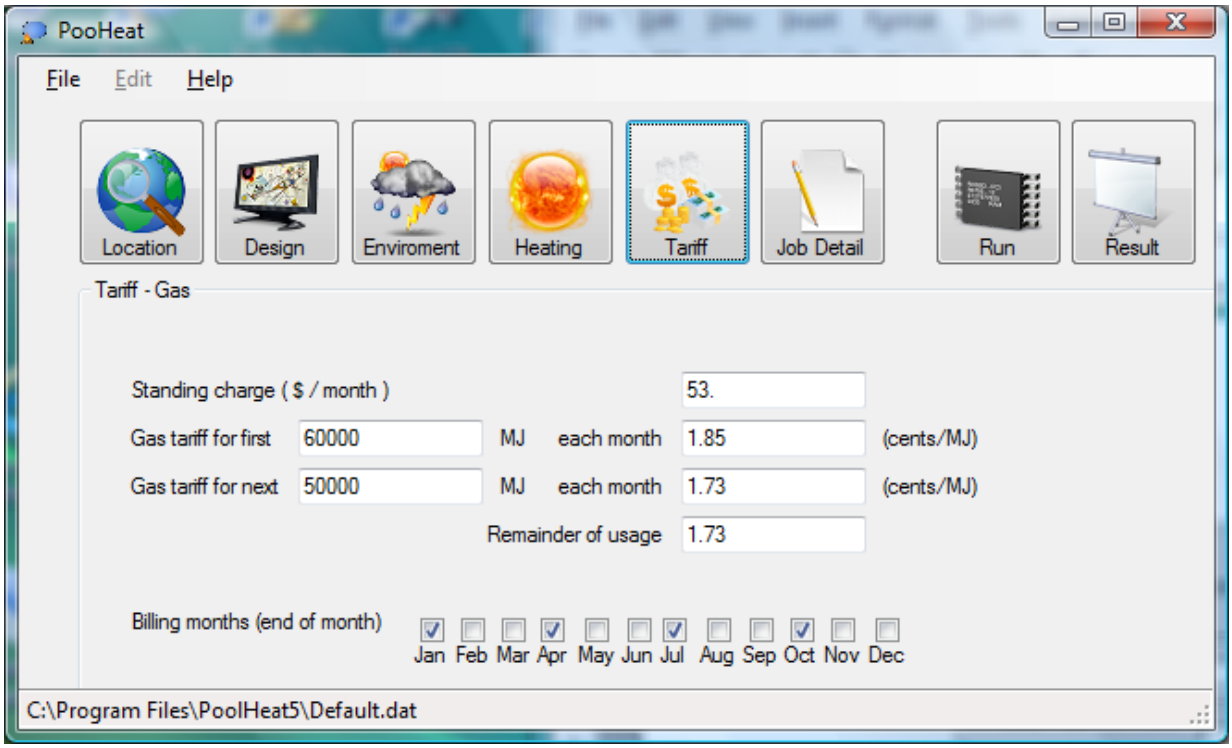
The **extended off peak electricity tariff** screen is



The **time of use electricity tariff** screens are



The **gas heating** tariff screen is

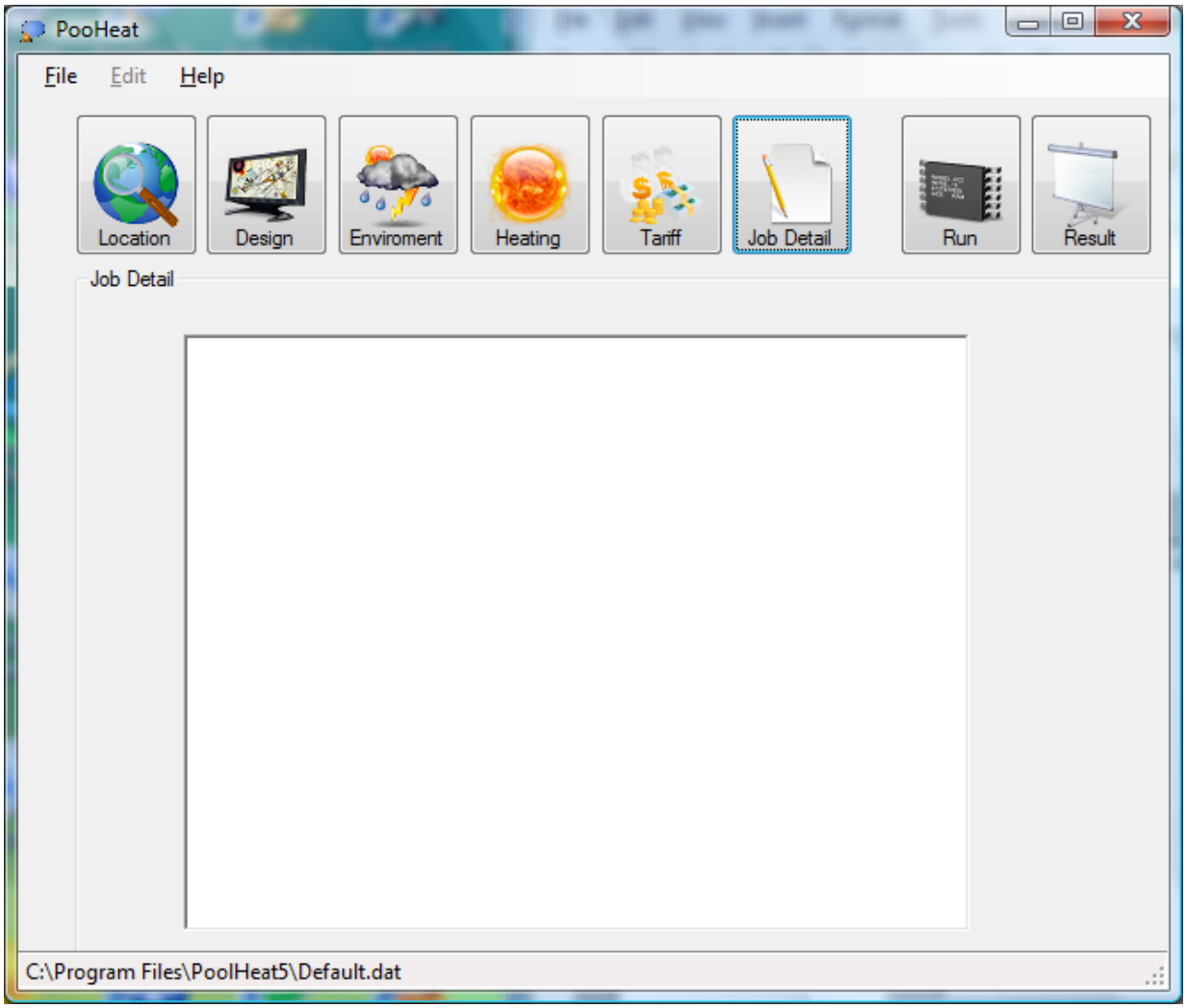


Billing Months

The months when a utility account is received can be specified at the bottom of the tariff screens.

JOB DETAILS

The job screen provides a note pad for entering details of the current job. This input is copied to the top of the result file.



RESULTS

The results can be viewed and printed by selecting the **Result** menu after the analysis is complete

Tabs are available for

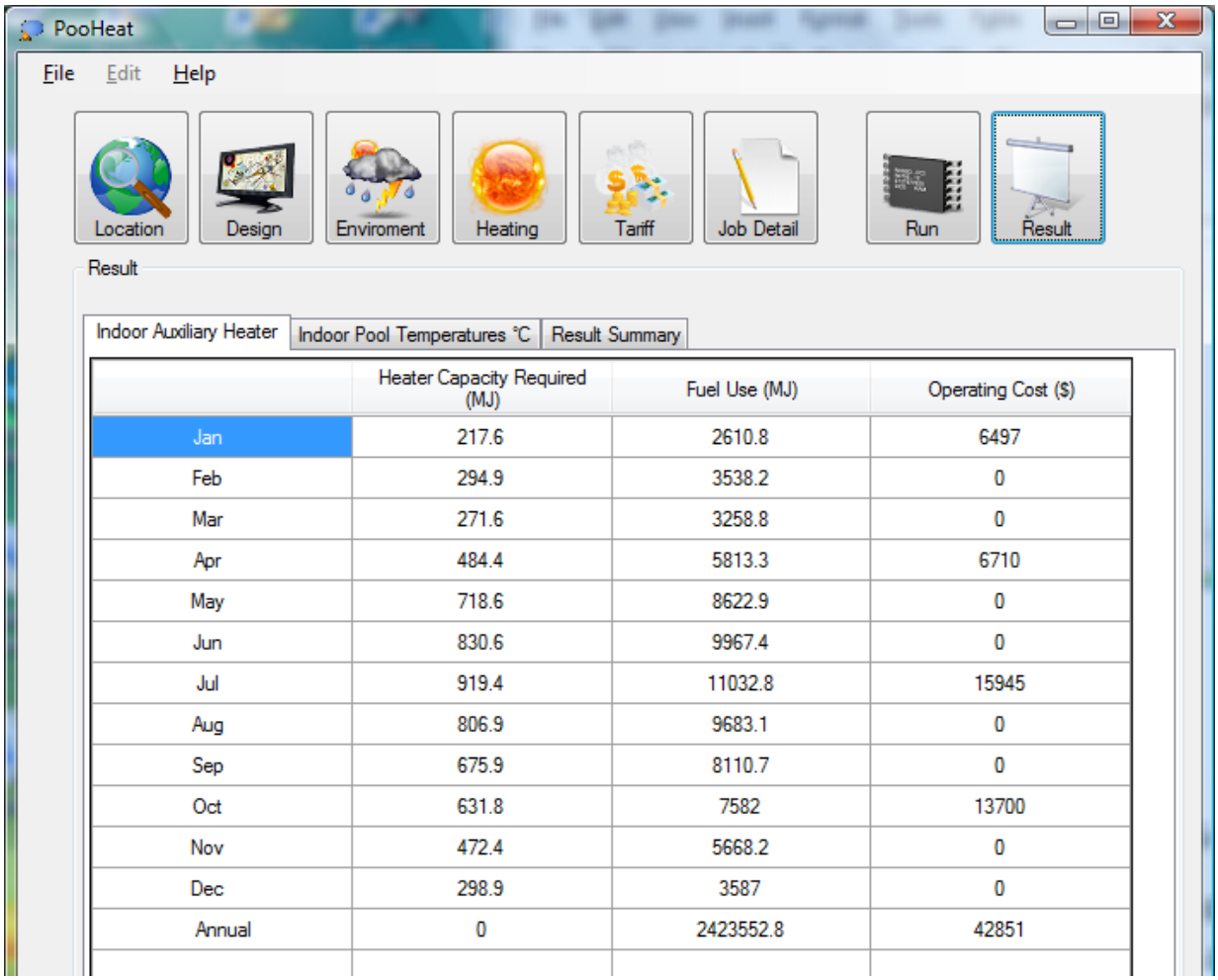
a) heater capacity, energy use and cost

b) pool temperatures (minimum and maximum temperatures are specified as values that are exceeded for 5% of the operation time)

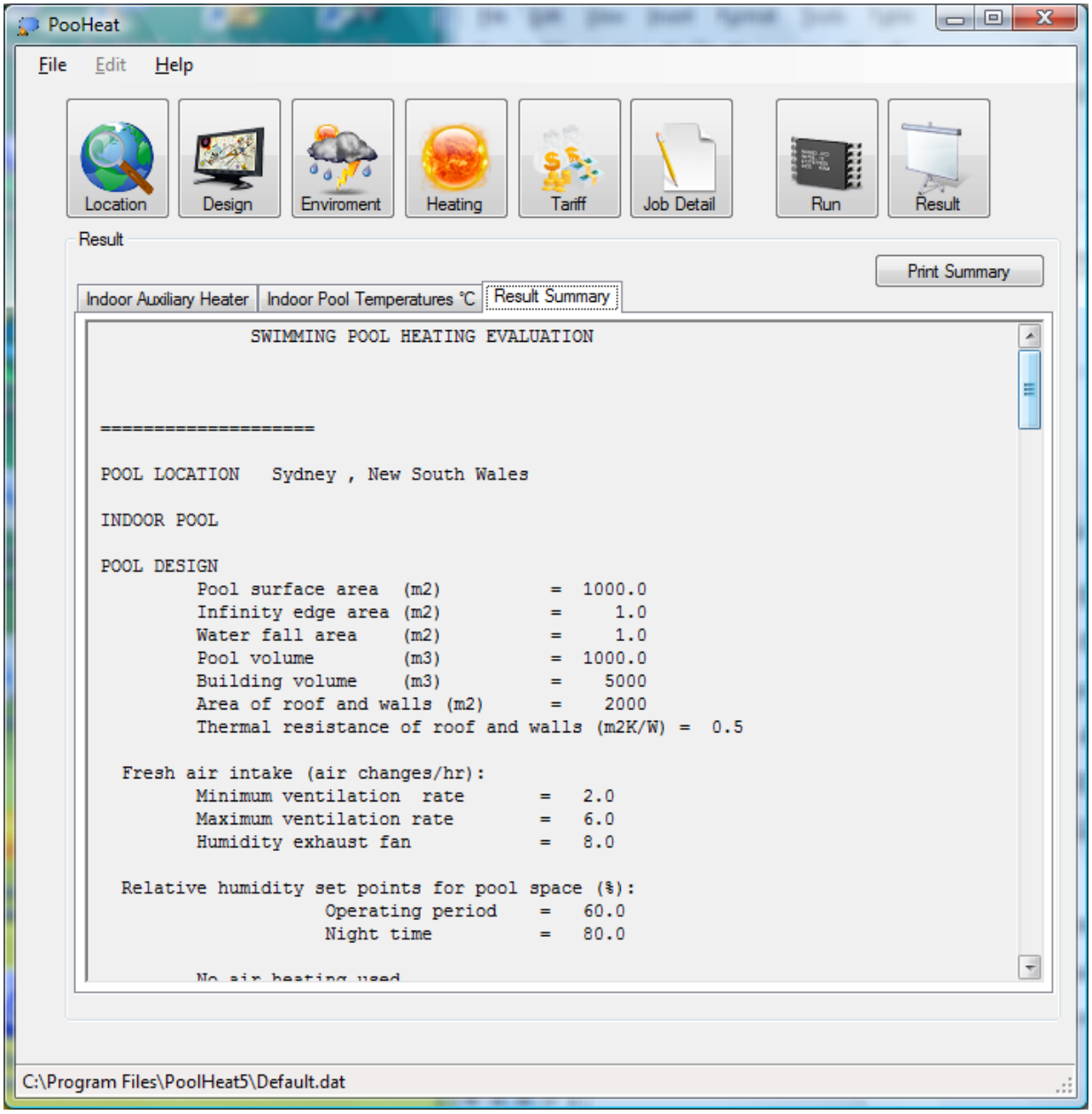
c) full result list.

A print option is available for the full result list. The result file (result.txt) is also saved in the user specified directory (File, Save As). If a directory has not been specified then the result file is saved in the program installation directory.

The result file can be read into an editor or word processor.



	Heater Capacity Required (MJ)	Fuel Use (MJ)	Operating Cost ($)
Jan	217.6	2610.8	6497
Feb	294.9	3538.2	0
Mar	271.6	3258.8	0
Apr	484.4	5813.3	6710
May	718.6	8622.9	0
Jun	830.6	9967.4	0
Jul	919.4	11032.8	15945
Aug	806.9	9683.1	0
Sep	675.9	8110.7	0
Oct	631.8	7582	13700
Nov	472.4	5668.2	0
Dec	298.9	3587	0
Annual	0	2423552.8	42851



Unheated pool temperature

The result file lists the monthly temperatures of an unheated pool as well as the heated pool. The temperature analysis for an unheated pool is for an identical pool to the heated system except the added heating system and pool cover (if used) are removed.

ANALYSIS OF RESULTS IN EXCEL

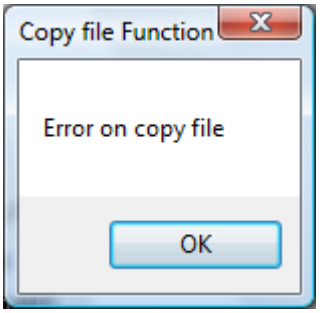
In addition to the POOLHEAT result file (file type .RES) there is an output file (file type .CSV) for transferring the results into EXCEL for graphical display of the output. Two EXCEL templates for analysing and graphing the output produced by POOLHEAT are included in the POOLHEAT working directory (EXCEL files POOLHEAT-INDOOR-POOL.XLS and POOLHEAT-OUTSIDE-POOL.XLS). These are separate from POOLHEAT and you need to have a copy of EXCEL to use them.

Once you have run a case you can open the EXCEL template (note there is a different template for outdoor and indoor pools) then read in the POOLHEAT result file name you used (file type .CSV) or default.csv if you did not save the run under a different file name.

If the progam inputs have been saved (File, Save As) to a user directory before Poolheat is run then the results will be in the user directory. If the inputs were not saved to a user directory before running Poolheat then all the results will be in the Poolheat installation directory.

The EXCEL templates include a typical result set. To put your results into these templates copy the lines of data in your .CSV result file into the DATA worksheet in the EXCEL template file. (The DATA worksheet tab is on the right hand end of the worksheet tabs).

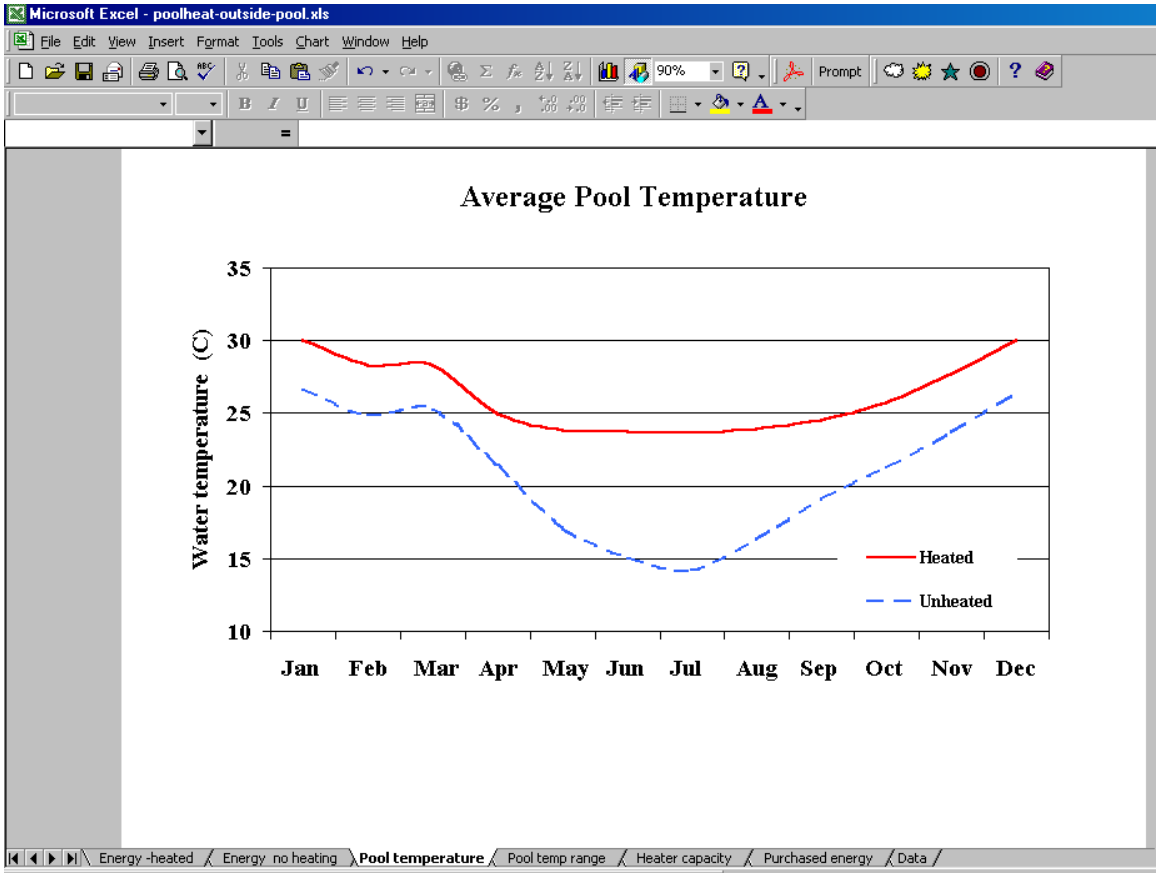
Note: If you have a result file open in EXCEL (eg RUN1.CSV) and you run POOLHEAT again using the same file name (RUN1) then the following error message will appear as the result file has been locked by EXCEL.



To proceed EXCEL must be closed or the data saved under a different file name.

EXCEL TEMPLATE

The EXCEL template (poolheat-outside-pool.xls) for an outdoor pool is shown below



The charts displayed for an outdoor pool are

Energy flows in a heated pool.

Energy flows in an unheated pool.

Pool temperature.

Range of pool temperature (maximum exceeded for 5% of the time and minimum temperature exceeded for 95% of the time).

Heater capacity required (specified capacity can also be set in POOLHEAT).

Purchased energy.

The charts displayed for an indoor pool are

Energy flows for indoor pool.

Pool temperature during daytime operating period.

Space temperature during daytime operating period.

Space humidity during daytime operating period.

Pool temperature at night.

Space temperature at night.

Space humidity at night.

Heater capacity required (specified capacity can also be set in POOLHEAT).

Purchased energy.

The templates display a typical data set when opened. The prepared graphs can be viewed by selecting the tags along the bottom of the EXCEL window. To view a graphical presentation of the case you have analysed the data from POOLHEAT must be read in to EXCEL and then copied into the Data work sheet in the EXCEL template (the right hand tag).

To read the results of a POOLHEAT analysis called RUN1 into EXCEL use the following procedure:

Open the POOLHEAT result file in EXCEL. The POOLHEAT file name for this example would be RUN1.CSV (select the **Text files** type in the EXCEL file-open menu).

This will produce an EXCEL worksheet as follows (partial view of worksheet shown)

	Weather			Energy Summary				Heater Capacity and Cost			Outdoor pool temperature					
	Ta	Gh	U	Total heat	Aux input	collector input	Solar contrib	Capacity required	Energy use	Energy cost	Average noheat	Average with heat	min and max pool temperatures 5% & 95% unheated		heated	
Jan	0	0	0.59	2148.32	0	2884.16	100	0	0	6	24.8	30.91	20.8	28.1	27.3	33.1
Feb	0	0	0.55	2961.79	0	1783.9	100	0	0	6	25.76	31.17	22.8	28.3	28.8	32.9
Mar	0	0	0.53	6540	0	6646.61	100	0	0	6	22.38	29.27	19.2	25.4	26	31.6
Apr	0	0	0.51	9394.83	1565.78	8090.68	83.79	144.98	1739.75	525.73	18.88	26.84	16.1	22	23.6	30
May	0	0	0.5	11171.52	5458.16	5000.81	47.81	505.39	6064.63	1704.03	16.37	24.69	14.6	18.7	23.2	27.1
Jun	0	0	0.48	14432.77	11499.56	3017.46	20.79	1064.77	12777.29	3364.21	13.1	23.89	11.4	14.6	22.6	25
Jul	0	0	0.55	16452.29	14390.99	1957.93	11.98	1332.5	15989.98	4319.36	12.33	23.73	10.4	14.3	22.5	24.7
Aug	0	0	0.59	13176.03	9446.78	4082.21	30.17	874.7	10496.42	2871.81	14.68	24.32	12	18.1	22.8	26.4
Sep	0	0	0.63	10454.1	4064.91	6819.91	62.66	376.38	4516.56	1257.72	16.76	25.3	14.8	18.9	23.1	27.9
Oct	0	0	0.65	8270.84	1141.01	6956.37	85.91	105.65	1267.79	399.02	20.24	27.9	16.4	23.9	23.9	30.9
Nov	0	0	0.65	5752.27	0	6190.12	100	0	0	6	22.64	29.52	19.6	27	26.8	31.9
Dec	0	0	0.65	3407.58	53.36	3030.94	98.27	4.94	59.29	24.38	24.43	30.31	19.6	28.2	25.8	32.9
Annual	0	0	0	3180113	1459107	1720824	54.11	0	1621230	14490.26	0	0	0	0	0	0

All the lines of this file should be selected (drag the mouse pointer down the left hand column of line numbers in EXCEL or press Ctrl A) and then copied to the clipboard. Paste the data over the dummy data in the **Data** worksheet in the appropriate outside or indoor EXCEL template. The charts in the EXCEL template will then show plots of the results from RUN1. The EXCEL charts can be edited to suit your application.

Summary of steps for loading new data into the EXCEL templates

1) Start Poolheat
2) Setup a user directory
   File
   Save as (eg save to c:\temp_poolheat\run1)
3) Run Poolheat (results will be saved into the directory c:\temp_poolheat)
4) Open the appropriate example EXCEL template (indoor or outdoor version).
5) Read you results into EXCEL from c:\temp_poolheat\run1.csv
6) Select all the data in your result file (eg CTRL A)
7) Copy all the data (right click copy)
8) Go to the DATA sheet in the EXCEL template and paste your data into the example EXCEL file.

NOTE before running Poolheat again you need to close the EXCEL file "run1.csv". If you do not close this file EXCEL will stop Poolheat from writing a new csv file.

REFERENCES

1. AS3634, Standards Australia, *Solar Heating Systems for Swimming Pools*.

2. ISO/TR12596, International Standards Organisation *Solar heating - Swimming pool heating systems - Dimensions, design and installation guidelines*.

3. K.I. Guthrie. *Testing of Solar Swimming Pool Heaters*, Victorian Solar Energy Council 1984.

4. ISO9806-3, International Standards Organisation. *Test Methods for solar collectors. Part 3. Thermal performance of unglazed liquid heating collectors*.