APPENDIX

APPENDIX A DESCRIPTION OF THE SENSOR FOR MEASUREMENT DATA

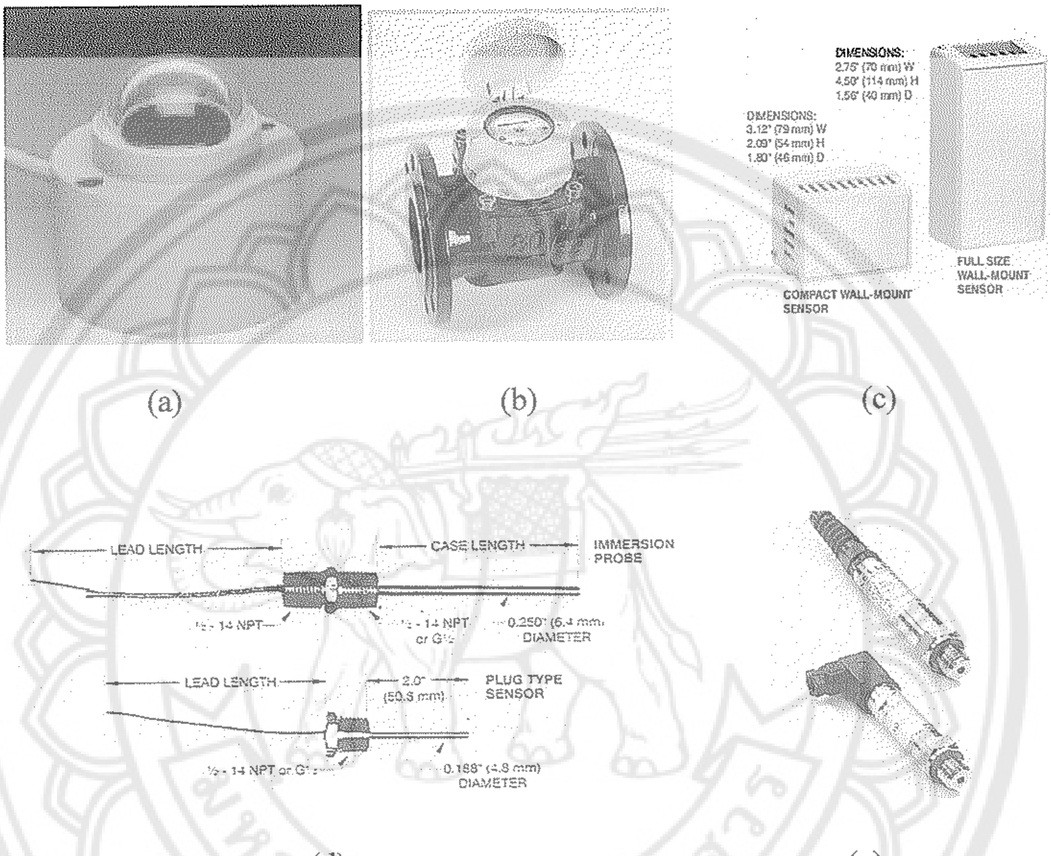


Figure 71 The sensors that used for measurement data

(a) A pyranormeter,

(b) A flow meter,

(c) A room air sensor,

(d) A temperature sensor,

(e) A pressure sensor

APPENDIX B DESCRIPTION OF USAGE BLOCK OF SIMULINK, MATLAB

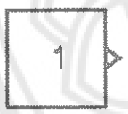
The Simulink, MATLAB Programming

The Simulink is a companion program to MATLAB, is an interactive system for simulation. It is a graphical mouse-driven program that allows user to model a system by drawing a block diagram on the screen and manipulating it dynamically. It can work with linear, non-linear, continuous-time, discrete-time, multirate, and hybrid systems. With the Block-sets are add-ons to Simulink that provide additional libraries of blocks for specialized applications like communications, signal processing, and power systems (The MathWorks. Inc., 2001).

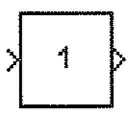
The Usage Bock-sets

In this work is considering the commonly used bock in Simulink because most equations are written in linear relation and it's easy to improve when connected to other external tools.

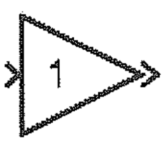
Description of Usage Block (The MathWorks. Inc., 2001).



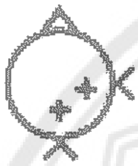
The Constant block generates a real or complex constant value. The block generates scalar (one-element array), vector (1-D array), or matrix (2-D array) output, depending on the dimensionality of the Constant value parameter and the setting of the Interpret vector parameters as 1-D parameter. Also, the block can generate either a sample-based or frame-based signal, depending on the setting of the Sampling mode parameter. The output of the block has the same dimensions and elements as the Constant value parameter. If the specify vector for this parameter, and to interpret the block as a vector (i.e., a 1-D array), select the Interpret vector parameters as 1-D parameter; otherwise, the block treats the Constant value parameter as a matrix (i.e., a 2-D array).



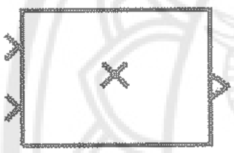
The Slider Gain block allowed to vary a scalar gain during a simulation using a slider. The block accepts one input and generates one output.



The Gain block multiplies the input by a constant value (gain). The input and the gain can each be a scalar, vector, or matrix. Specify the value of the gain in the Gain parameter. The Multiplication parameter specify element-wise or matrix multiplication. For matrix multiplication, this parameter also lets indicated the order of the multiplicands. The gain is converted from doubles to the data specified in the block mask offline using round-to-nearest and saturation. The input and gain are then multiplied, and the result is converted to the output data type using the specified rounding and overflows modes.



The Sum block performs addition or subtraction on its inputs. This block can add or subtract scalar, vector, or matrix inputs. It can also collapse the elements of a single input vector. Specify the operations of the block with the List of signs parameter. Plus (+), minus (-), and spacer (|) characters indicate the operations to be performed on the inputs.



The Product block performs multiplication or division of its inputs. This block produces outputs using either element-wise or matrix multiplication, depending on the value of the Multiplication parameter. Specify the operations with the Number of inputs parameter. Multiply (*) and divide (/) characters indicate the operations to be performed on the inputs.

The Display block shows the value of its input on its icon.

APPENDIX C FITTED CURVE EQUATION

Table 15 Solar cooling system equation without auxiliary usage (winter)

Supply

Equation	Relative error (%) 31-Jan-07	1-Feb-07	2-Feb-07	Average
$Q'_0 = -0.9000 + 0.0762G_\beta$	-3.5	-3.69	-3.45	**-3.55**
$Q'_{collector} = -3.5556 + 0.0502G_\beta$	-8.47	-1.83	-2.68	**-4.33**
$\Delta T_{2\text{-}1} = -0.8586 + 0.0069G_\beta$	-5.85	-9.04	-16.68	**-10.52**
$Q'_{storage} = -26.2170 - 0.1431G_\beta$	12.48	21.89	20.98	**18.45**
$Q'_{storage} = -144.8449 + 3.3544T_S$	5.07	5.18	6.5	**5.58**
$\Delta T_{S\text{-}1} = -0.7519 + 0.0041G_\beta$	14.28	31.55	29.61	**25.15**
$Q'_{gen} = 0.4467 - 0.0203G_\beta$	8.92	8.66	8.53	**8.70**
$\Delta T_{3\text{-}4} = -0.9109 + 0.0068G_\beta$	1.8	5.79	19.24	**8.94**

Demand

Equation	Relative error (%) 31-Jan-07	1-Feb-07	2-Feb-07	Average
$Q'_{evap} = -5.063 + 0.021G_\beta$	14.58	10.04	12.83	**12.48**
$\Delta T_{7\text{-}8} = 0.6269 + 0.0007G_\beta$	28.66	35.32	21.39	**28.46**

Reject

Equation	Relative error (%) 31-Jan-07	1-Feb-07	2-Feb-07	Average
$Q'_{rej} = -5.0500 + 0.047G_\beta$	9.3	20.26	14.65	**11.05**
$\Delta T_{6\text{-}5} = 0.4401 + 0.0010G_\beta$	29.22	25.16	18.36	**18.19**

Performance

Equation	**Relative error (%)** 20-Jun-07	21-Jun-07	22-Jun-07	**Average**
COP $= 0.268 + 0.0005G_\beta$	4.28	12.3	15.79	**10.79**

Table 16 Solar cooling system equation without auxiliary usage (summer)

Supply

Equation	Relative error (%)				
	23-Apr-07	24-Apr-07	25-Apr-07	26-Apr-07	Average
$Q'_0 = 0.5998 + 0.0712G_\beta$	-0.02	-0.05	-0.5	-1.67	**-0.56**
$Q'_{collector} = -2.4932 + 0.0496G_\beta$	0.28	-0.15	-2.04	-9.04	**-2.74**
$Q'_1 = 1.6285 + 0.0228G_\beta$	2.88	3.03	1.32	-0.52	**1.68**
$\Delta T_{2-1} = 0.1832 + 0.0057G_\beta$	3.79	3.9	3.27	1.61	**3.14**
$Q'_{storage} = 31.3802 + 0.1105G_\beta$	7.74	-1.54	0.52	0.48	**1.80**
$\Delta T_{S-1} = 0.0109 + 0.0032G_\beta$	7.6	-2.09	-0.15	0.08	**1.36**
$Q'_{gen} = -0.1738 + 0.0195G_\beta$	8.76	6.28	7	11.63	**8.42**
$\Delta T_{3-4} = -0.0109 + 0.0028G_\beta$	7.88	.58	0.14	10.37	**5.74**

Demand

Equation	Relative error (%)				
	23-Apr-07	24-Apr-07	25-Apr-07	26-Apr-07	Average
$Q'_{evap} = -5.024 + 0.021G_\beta$	-15.06	0.56	0.23	0.58	**-3.42**
$\Delta T_{7-8} = 0.0013 + 0.3600G_\beta$	-5.04	1.53	-4.41	13.25	**1.33**

Reject

Equation	Relative error (%)				
	23-Apr-07	24-Apr-07	25-Apr-07	26-Apr-07	Average
$Q'_{rej} = 18.9572 + 0.0191G_\beta$	-5.09	1.79	-10.72	1.91	**-3.03**
$\Delta T_{6-5} = 0.3662 + 0.0014G_\beta$	-4.46	-5.83	-4.77	7.16	**-1.98**

Performance

Equation	Relative error (%)				
	23-Apr-07	24-Apr-07	25-Apr-07	26-Apr-07	Average
$COP = 0.294 + 0.0002G_\beta$	36.65	16.35	-54.3	-1.36	**-0.66**

Table 17 Solar cooling system equation with auxiliary usage (rainy season)

Supply

Equation	Relative error (%) 20-Jun-07	21-Jun-07	22-Jun-07	23-Jun-07	Average
$Q'_0 = 1.7862 + 0.0693G_\beta$	-0.45	-0.86	-0.67	-1.78	**-0.94**
$Q'_{collector} = -3.6589 + 0.0489G_\beta$	-1.58	-3.33	-1.66	-0.75	**-1.83**
$Q'_1 = 16.3346 - 0.0015G_\beta$	9.39	6.52	-10.48	8.85	**3.57**
$\Delta T_{2-1} = -0.0928 + 0.0056G_\beta$	6.61	6.73	-2.84	8.59	**4.77**
$Q'_{storage} = 83.8219 - 0.0112G_\beta$	18.91	3.31	-12.87	8.57	**4.48**
$\Delta T_{S-1} = -0.8318 + 0.0043G_\beta$	14.03	15.21	6.76	4.44	**10.11**
$Q'_{aux} = 2.9198 + 0.0007G_\beta$	6.96	23.11	12.61	4.19	**11.72**
$Q'_{gen} = 18.9764 - 0.0009G_\beta$	0.33	-5.88	-14.58	-14.61	**-8.69**
$\Delta T_{3-4} = 2.7928 - 0.0006G_\beta$	1.43	-9.12	-10.21	-10.34	**-7.06**
$SOLF = 0.0630 + 0.0004G_\beta$	14.12	17.54	22.69	5.4	**14.94**
$SOLF = 0.3689 - 0.0410Q'_s$	-40.51	12.48	15.78	7.03	**-1.31**

Demand

Equation	Relative error (%) 20-Jun-07	21-Jun-07	22-Jun-07	23-Jun-07	Average
$Q'_{evap} = 13.5972 - 0.0024G_\beta$	-0.98	-0.83	-2.9	-15.94	-5.16
$\Delta T_{7-8} = 2.7928 - 0.0006G_\beta$	1.43	-9.12	-10.21	-10.34	-7.06

Reject

Equation	Relative error (%) 20-Jun-07	21-Jun-07	22-Jun-07	23-Jun-07	Average
$Q'_{rej} = 37.1749 + 0.0021G_\beta$	5.09	1.3	5.15	-12.74	**-0.30**
$\Delta T_{6-5} = 1.7708 - 0.0001G_\beta$	2.72	2.2	1.46	-7.17	**-0.20**

Table 17 (Cont)

Performance

Equation	Relative error (%)				
	20-Jun-07	21-Jun-07	22-Jun-07	23-Jun-07	Average
COP = 0.671 - 0.0002G_β	5.37	10.41	-15.1	13.03	3.43

APPENDIX D THE COMPUTATION OF IRR, PB, NPV And B/C FOR A SOLAR COOLING AT SERT

Table 18 The computation of IRR for a solar cooling at SERT

IRR (%)	COP					
$SOLF_{the}$	0.2	0.3	0.4	0.5	0.6	0.7
0.4	9.01	9.04	9.06	9.07	9.08	9.09
0.5	9.01	9.05	9.07	9.08	9.08	9.09
0.6	9.02	9.05	9.07	9.08	9.09	9.09
0.7	9.03	9.06	9.07	9.08	9.09	9.09
0.8	9.04	9.06	9.08	9.09	9.09	9.09
0.9	9.04	9.07	9.08	9.09	9.09	9.1

Table 19 The computation of PP for a solar cooling at SERT

PB (Year)	COP					
$SOLF_{the}$	0.2	0.3	0.4	0.5	0.6	0.7
0.4	13.8	13.8	13.8	13.8	13.8	13.8
0.5	13.8	13.8	13.8	13.8	13.8	13.8
0.6	13.8	13.8	13.8	13.8	13.8	13.8
0.7	13.8	13.8	13.8	13.8	13.8	13.8
0.8	13.8	13.8	13.8	13.8	13.8	13.8
0.9	13.8	13.8	13.8	13.8	13.8	13.8

Table 20 The computation of NPV for a solar cooling at SERT

NPV (Bath)	COP					
SOLF$_{the}$	0.2	0.3	0.4	0.5	0.6	0.7
0.4	766,096	780,040	787,012	791,195	794,046	795,976
0.5	768,865	781,886	788,396	792,304	794,969	796,767
0.6	771,708	783,781	789,818	793,440	795,917	797,579
0.7	774,477	785,627	791,203	794,548	796,840	798,370
0.8	777,246	787,473	792,587	795,655	797,763	799,161
0.9	780,015	789,319	793,971	796,763	798,686	799,953

Table 21 The computation of B/C Ratio for a solar cooling at SERT

B/C Ratio	COP					
SOLF$_{the}$	0.2	0.3	0.4	0.5	0.6	0.7
0.4	1.26	1.26	1.26	1.27	1.27	1.27
0.5	1.26	1.26	1.27	1.27	1.27	1.27
0.6	1.26	1.26	1.27	1.27	1.27	1.27
0.7	1.26	1.26	1.27	1.27	1.27	1.27
0.8	1.26	1.26	1.27	1.27	1.27	1.27
0.9	1.26	1.27	1.27	1.27	1.27	1.27