MSD P11411 Technical Review Agenda

Meeting Purpose: Detailed design review of P11411- Dubai Desalination System. The objectives of this design review is to present and receive feedback from our Customer, Guide, and others about our updated project plan, feasibility analysis, system specifications, system design diagram, design CAD drawings and schematics, test plan, plan of action, bill of materials, updated risk assessment, and multicultural preparation.

Materials to be Reviewed:

Updated Project Plan
Feasibility Analysis
System Specifications
System Design Diagram
Design CAD Drawings and Schematics
Test Plan
Plan of Action
Bill of Materials
Updated Risk Assessment
Multicultural Preparation

Meeting Date: February 14, 2011

Meeting Location: 09-2550

Meeting time: 6:00 – 9:00 a.m. EST

Meeting Agenda Timeline:

Meeting Timeline		
Start time	**Topic of Review**	**Required Attendees**
6:00	Updated Project Plan (Sergey)	Dr. Edward Hensel, Gerry Garavuso
6:10	Feasibility Analysis (All Members)	Dr. Edward Hensel, Gerry Garavuso
6:30	Questions and Comments	Dr. Edward Hensel, Gerry Garavuso
6:40	System Specifications (Dubai Members)	Dr. Edward Hensel, Gerry Garavuso
6:50	System Design Diagram (Kelsey)	Dr. Edward Hensel, Gerry Garavuso
7:00	Design CAD Drawings and Schematics (All Members)	Dr. Edward Hensel, Gerry Garavuso
7:20	Questions and Comments	Dr. Edward Hensel, Gerry Garavuso
7:30	Test Plan (Kelsey)	Dr. Edward Hensel, Gerry Garavuso
7:45	Plan of Action (Kelsey)	Dr. Edward Hensel, Gerry Garavuso
7:55	Questions and Comments	Dr. Edward Hensel, Gerry Garavuso
8:05	Bill of Materials (Sergey)	Dr. Edward Hensel, Gerry Garavuso
8:15	Updated Risk Assessment (Dubai Members)	Dr. Edward Hensel, Gerry Garavuso
8:25	Multicultural Preparation (Dubai Members)	Dr. Edward Hensel, Gerry Garavuso
8:35	Questions and Comments	Dr. Edward Hensel, Gerry Garavuso

Updated Project Plan

ID	Task Name	Duration	Start	Finish	Predecessors	Resource Names
1	**Week 1**	**1 day?**	**Fri 12/3/10**	**Fri 12/3/10**		
2	Review PRP	1 day?	Fri 12/3/10	Fri 12/3/10		Team
3	Choose Project Manager	1 day?	Fri 12/3/10	Fri 12/3/10		Team
4	Initial Team Meeting with Guide	1 day?	Fri 12/3/10	Fri 12/3/10		Team
5	1 Page Project Summary	1 day?	Fri 12/3/10	Fri 12/3/10	2,4	Sergey
6	**Week 2**	**5 days?**	**Mon 12/6/10**	**Fri 12/10/10**		
7	Weekly Skype Meeting	1 day?	Mon 12/6/10	Mon 12/6/10		Team
8	HW1	5 days?	Mon 12/6/10	Fri 12/10/10		Team Roc
9	Define Rolas and Responsibilities	5 days?	Mon 12/6/10	Fri 12/10/10	3	Team
10	Norms and Values	5 days	Mon 12/6/10	Fri 12/10/10	9	Team
11	Establish International Logistics	5 days?	Mon 12/6/10	Fri 12/10/10		Team
12	**Week 3**	**20 days?**	**Mon 12/13/10**	**Fri 1/7/11**		
13	Weekly Skype Meeting	1 day?	Mon 12/13/10	Mon 12/13/10	7	Team
14	Project Functions	16 days?	Mon 12/13/10	Mon 1/3/11		Team
15	Customer Objectives	20 days?	Mon 12/13/10	Fri 1/7/11		Team
16	Interview with Hensel	1 day?	Thu 12/16/10	Thu 12/16/10	15	Team Roc
17	Customer Needs	16 days?	Fri 12/17/10	Fri 1/7/11	16	Sergey
18	Stakeholders List	16 days?	Fri 12/17/10	Fri 1/7/11		Team
19	Weekly Skype Meeting	1 day?	Mon 12/20/10	Mon 12/20/10		Team
20	Escalation Process for Issues	2 days?	Mon 12/27/10	Tue 12/28/10		Sergey
21	**Week 4**	**8 days?**	**Mon 1/3/11**	**Wed 1/12/11**		
22	Weekly Skype Meeting	1 day?	Mon 1/3/11	Mon 1/3/11	13	Team
23	Mission Statement	5 days?	Mon 1/3/11	Fri 1/7/11		Wayne,Sergey
24	HW2	5 days?	Mon 1/3/11	Fri 1/7/11	8	Team Dubai
25	House of Quality	7 days?	Mon 1/3/11	Tue 1/11/11		Wayne
26	Project Concepts	5 days?	Tue 1/4/11	Mon 1/10/11	14	Kelsey
27	Engineering Specifications	7 days?	Mon 1/3/11	Tue 1/11/11		Wayne
28	Risk Assessment	5 days?	Mon 1/3/11	Fri 1/7/11		Team Dubai
29	Research Functions	1 day?	Tue 1/11/11	Tue 1/11/11	14	Team
30	Research Benchmarks	7 days?	Mon 1/3/11	Tue 1/11/11		Team
31	Peer Evaluations	5 days?	Mon 1/3/11	Fri 1/7/11		Team
32	Concept Generatiom	8 days?	Mon 1/3/11	Wed 1/12/11		Team
33	**Week 5**	**5 days?**	**Mon 1/10/11**	**Fri 1/14/11**		
34	Weekly Skype Meeting	1 day?	Mon 1/10/11	Mon 1/10/11	22	Team

ID	Task Name	Duration	Start	Finish	Predecessors	Resource Names
35	Function Tree	3 days?	Wed 1/12/11	Fri 1/14/11	29	Team Roc
36	Required Resources	1 day?	Mon 1/10/11	Mon 1/10/11		Sergey
37	Dubai Desalination Plant Tour	5 days?	Mon 1/10/11	Fri 1/14/11		Team Dubai
38	System Analysis and System Design Options	2 days?	Wed 1/12/11	Thu 1/13/11	26,29	Team
39	RIT Student Surveys	5 days?	Mon 1/10/11	Fri 1/14/11		Kelsey
40	Systems Design Review	1 day?	Thu 1/13/11	Thu 1/13/11	5,10,14,15,16,17,1	Team
41	**Week 6**	**5 days?**	**Mon 1/17/11**	**Fri 1/21/11**		
42	Weekly Skype Meeting	1 day?	Mon 1/17/11	Mon 1/17/11		Team
43	HW3	5 days?	Mon 1/17/11	Fri 1/21/11	8,24	Team Roc
44	Problem Solving HW	5 days?	Mon 1/17/11	Fri 1/21/11		Team Dubai
45	**Week 7**	**13 days?**	**Mon 1/24/11**	**Wed 2/9/11**		
46	Weekly Skype Meeting	1 day?	Mon 1/24/11	Mon 1/24/11		Team
47	CAD, Schematcs, Code Diagrams Simulation	13 days?	Mon 1/24/11	Wed 2/9/11	40	Team
48	Feasibility Analysis	13 days?	Mon 1/24/11	Wed 2/9/11	40	Team
49	System Specifications	10 days?	Mon 1/24/11	Fri 2/4/11		Team Dubai
50	Updated Risk Assessment	13 days?	Mon 1/24/11	Wed 2/9/11	28	Team Roc
51	Multi-Cultural and Multi-National Logistics Document	11 days?	Mon 1/24/11	Mon 2/7/11		Team Dubai
52	**Week 8**	**5 days?**	**Mon 1/31/11**	**Fri 2/4/11**		
53	Weekly Skype Meeting	1 day?	Mon 1/31/11	Mon 1/31/11		Team
54	Dubai Student Surveys	5 days?	Mon 1/31/11	Fri 2/4/11		Team Dubai
55	RIT Faculty Surveys	5 days?	Mon 1/31/11	Fri 2/4/11		Sergey
56	Project Management HW	5 days?	Mon 1/31/11	Fri 2/4/11		Sergey
57	Project and Test Plan	5 days?	Mon 1/31/11	Fri 2/4/11		Kelsey
58	**Week 9**	**7 days?**	**Mon 2/7/11**	**Tue 2/15/11**		
59	Weekly Skype Meeting	1 day?	Mon 2/7/11	Mon 2/7/11		Team
60	System Design Diagram	3 days?	Mon 2/7/11	Wed 2/9/11		Kelsey
61	Bill of Materials	4 days?	Thu 2/10/11	Tue 2/15/11	40,47	Team
62	DDR Mock Run	1 day?	Fri 2/11/11	Fri 2/11/11		Team Roc
63	**Week 10**	**34 days?**	**Mon 1/10/11**	**Thu 2/24/11**		
64	Detailed Design Review	1 day?	Mon 2/14/11	Mon 2/14/11		Team
65	Project Review with Guide	4 days?	Tue 2/15/11	Fri 2/18/11	64	Team
66	Design Changes Per DDR	1 day?	Fri 2/18/11	Fri 2/18/11	64	Team
67	Order Parts	8 days?	Tue 2/15/11	Thu 2/24/11	64	Sergey
68	Peer Evaluations	1 day?	Mon 1/10/11	Mon 1/10/11		

Figure 1. MSDI Project Plan

ID	Task Name	Duration	Start	Finish	Predecessors	Resource Names
69	**Week 11**	**15 days?**	**Mon 2/7/11**	**Fri 2/25/11**		
70	Weekly Skype Meeting	1 day?	Mon 2/7/11	Mon 2/7/11		Team
71	Project Design File	5 days?	Mon 2/21/11	Fri 2/25/11	64,65	Team
72	Go or No Go Revision	5 days?	Mon 2/21/11	Fri 2/25/11	65	Team
73	**Week 12**	**10 days?**	**Mon 3/7/11**	**Fri 3/18/11**		
74	Team MSDII Kick-Off Meeting	1 day?	Mon 3/7/11	Mon 3/7/11		Team
75	Decide on Team Meetings and Work Sessions	1 day?	Mon 3/7/11	Mon 3/7/11		Team
76	Closure of MSDI Action Items	5 days?	Mon 3/7/11	Fri 3/11/11		Team
77	Assembly And Manufacturing Plan	5 days?	Mon 3/7/11	Fri 3/11/11		Team
78	Receive Parts	5 days?	Mon 3/7/11	Fri 3/11/11	67	Sergey
79	Inspect Parts	5 days?	Mon 3/14/11	Fri 3/18/11	78	Sergey
80	Finalize Test Plan Per DDR	5 days?	Mon 3/7/11	Fri 3/11/11	71,72	Team
81	**Week 13**	**5 days?**	**Mon 3/14/11**	**Fri 3/18/11**		
82	Receive Parts	5 days?	Mon 3/14/11	Fri 3/18/11	67	Sergey
83	Inspect Parts	5 days?	Mon 3/14/11	Fri 3/18/11		Sergey
84	Design Verification Part 1	5 days?	Mon 3/14/11	Fri 3/18/11		Team
85	Assembly Part 1	5 days?	Mon 3/14/11	Fri 3/18/11		Team
86	Debug Assembly Part 1	5 days?	Mon 3/14/11	Fri 3/18/11		Team
87	Assembly and Verification Documentation Part 1	5 days?	Mon 3/14/11	Fri 3/18/11		Team
88	**Week 14**	**5 days?**	**Mon 3/21/11**	**Fri 3/25/11**		
89	Receive Parts	5 days?	Mon 3/21/11	Fri 3/25/11	67	Sergey
90	Inspect Parts	5 days?	Mon 3/21/11	Fri 3/25/11		Sergey
91	Design Verification Part 2	5 days?	Mon 3/21/11	Fri 3/25/11		Team
92	Assembly Part 2	5 days?	Mon 3/21/11	Fri 3/25/11	85	Team
93	Debug Assembly Part 2	5 days?	Mon 3/21/11	Fri 3/25/11		Team
94	Assembly and Verification Documentation Part 2	5 days?	Mon 3/21/11	Fri 3/25/11		Team
95	Update Customer/Guide	5 days?	Mon 3/21/11	Fri 3/25/11		Team
96	Implement Countermeasures Per Customer/Guide	5 days?	Mon 3/21/11	Fri 3/25/11		Team
97	**Week 15**	**5 days?**	**Mon 3/28/11**	**Sun 4/3/11**		
98	Receive Parts	5 days?	Mon 3/28/11	Fri 4/1/11	67	Sergey
99	Inspect Parts	5 days?	Mon 3/28/11	Fri 4/1/11		Sergey
100	Design Verification Part 3	5 days?	Mon 3/28/11	Fri 4/1/11		Team
101	Assembly Part 3	3 days?	Mon 3/28/11	Wed 3/30/11	93	Team
102	Debug Assembly Part 3	3 days?	Mon 3/28/11	Wed 3/30/11		Team

ID	Task Name	Duration	Start	Finish	Predecessors	Resource Names
103	Assembly and Verification Documentation Part 3	3 days?	Mon 3/28/11	Wed 3/30/11		Team
104	Testing and Refinement: System Test	2 days?	Thu 3/31/11	Sun 4/3/11	103	Team
105	**Week 16**	**5 days?**	**Mon 4/4/11**	**Fri 4/8/11**		
106	Testing and Refinement: Data Acquisition Test	2 days?	Mon 4/4/11	Tue 4/5/11	104	Team
107	Testing and Refinement: Specifications Test	4 days?	Tue 4/5/11	Fri 4/8/11		Team
108	Testing and Refinement Documentation	5 days?	Mon 4/4/11	Fri 4/8/11		Team
109	Peer Evaluations	5 days?	Mon 4/4/11	Fri 4/8/11		Team
110	**Week 17**	**15 days?**	**Mon 4/11/11**	**Fri 4/29/11**		
111	Technical Paper	15 days?	Mon 4/11/11	Fri 4/29/11		Team
112	Testing and Refinement (Built-In Slack Time)	5 days?	Mon 4/11/11	Fri 4/15/11		Team
113	**Week 18**	**5 days?**	**Mon 4/18/11**	**Fri 4/22/11**		
114	Field Demo	5 days?	Mon 4/18/11	Fri 4/22/11		Team
115	Update Customer/Guide	5 days?	Mon 4/18/11	Fri 4/22/11		Team
116	Implement Countermeasures Per Customer/Guide	5 days?	Mon 4/18/11	Fri 4/22/11		Team
117	**Week 19**	**5 days?**	**Mon 4/25/11**	**Fri 4/29/11**		
118	Prepare for Imagine RIT Exhibition	5 days?	Mon 4/25/11	Fri 4/29/11	116	Team
119	Poster	5 days?	Mon 4/25/11	Fri 4/29/11		Team
120	**Week 20**	**6 days?**	**Mon 5/2/11**	**Sat 5/7/11**		
121	Imagine RIT Exhibition	1 day?	Sat 5/7/11	Sat 5/7/11		Team
122	Prepare for Project Review (Team Rehearsal)	5 days?	Mon 5/2/11	Fri 5/6/11		Team
123	**Week 21**	**5 days?**	**Mon 5/9/11**	**Fri 5/13/11**		
124	Team Self-Assessment	5 days?	Mon 5/9/11	Fri 5/13/11		Team
125	Project Review	5 days?	Mon 5/9/11	Fri 5/13/11		Team
126	Poster Session	5 days?	Mon 5/9/11	Fri 5/13/11	119	Team
127	Final Demo, Sponsor Demo and Transfer Completed	5 days?	Mon 5/9/11	Fri 5/13/11		Team
128	Publish Technical Paper	5 days?	Mon 5/9/11	Fri 5/13/11		Team
129	Peer Evaluations	5 days?	Mon 5/9/11	Fri 5/13/11		Team
130	**Week 22**	**5 days?**	**Mon 5/16/11**	**Fri 5/20/11**		
131	Project Design File	5 days?	Mon 5/16/11	Fri 5/20/11	129	Team
132	**Ongoing**	**126 days?**	**Mon 11/29/10**	**Fri 5/20/11**		
133	Researching Dubai Material Costs	125 days?	Mon 11/29/10	Fri 5/20/11		Team Dubai
134	Updating Engineering Logbooks	125 days?	Mon 11/29/10	Thu 5/19/11		Team
135	Updating Roles and Responsibilities	125 days?	Mon 11/29/10	Thu 5/19/11		Team
136	Updating International Logistics	125 days?	Mon 11/29/10	Thu 5/19/11		Team

Figure 2. MSDII Project Plan

Feasibility Analysis

Solar Still

TMY3 Data:

This data provides hourly temperature and Solar Insolation Readings for Rochester NY taken at the Airport. This data represents the typical meteorological year for Rochester, NY. Below are the Daily values for average temperature and the total solar insolation for each day of the year calculated from this data set. A smooth sinusoidal fit was also calculated for these two graphs and used in the sensitivity analysis which is discussed later.

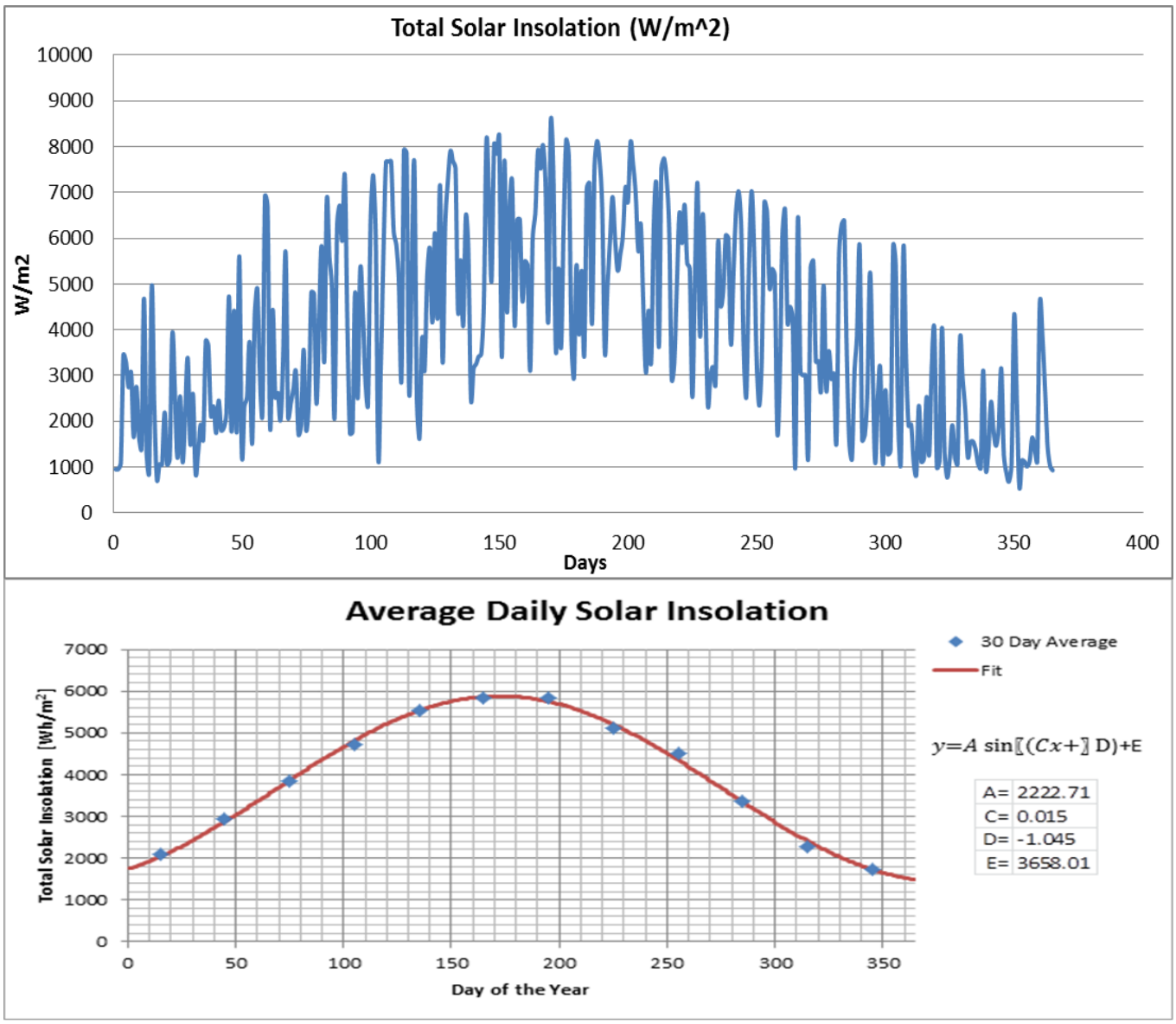


Figure 3. Total Solar Insolation and Average Daily Solar Insolation

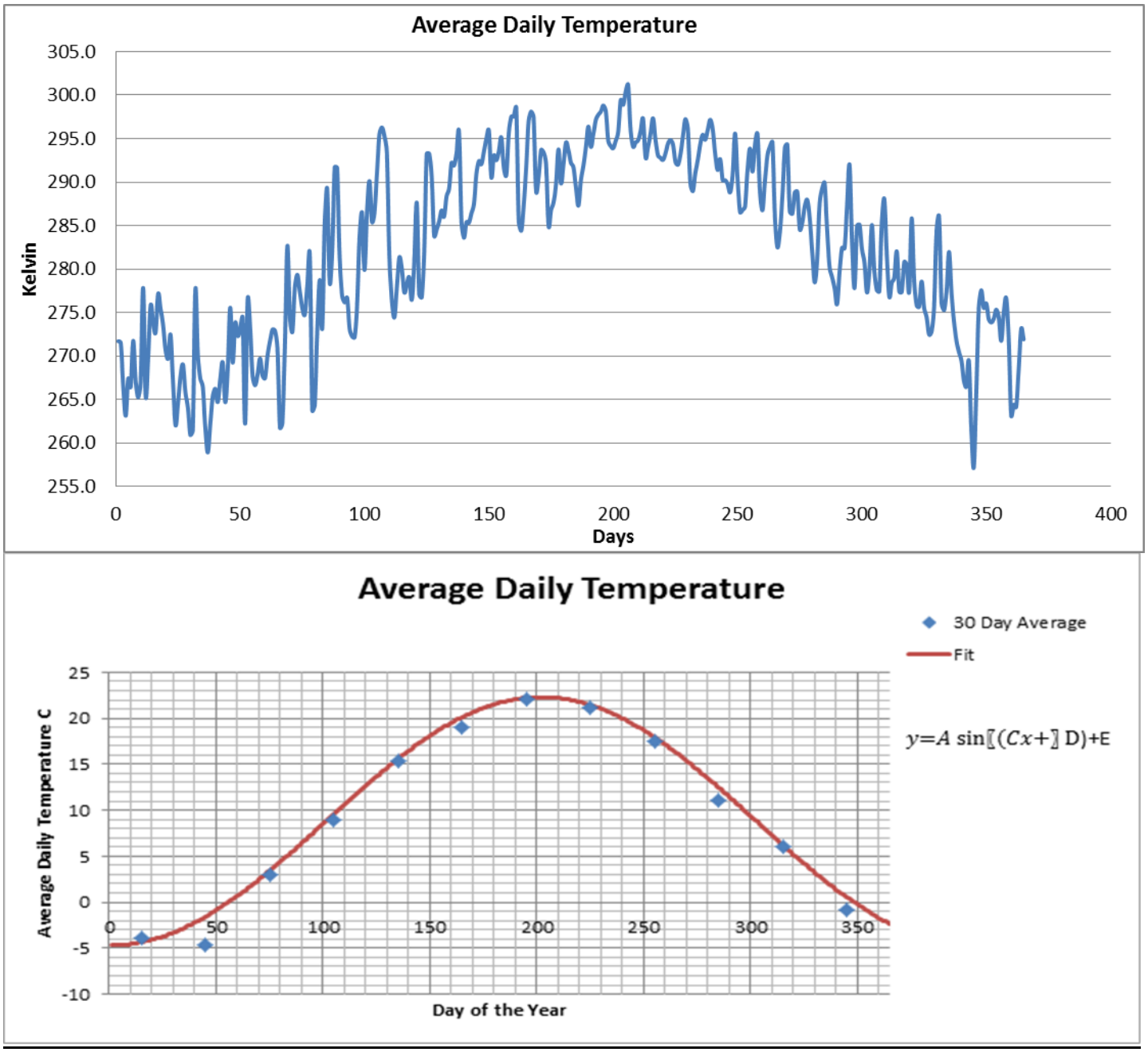


Figure 4. Average Daily Temperature

Theoretical Model:

"Experimental and theoretical method for the determination of the daily output of a solar still: input-output method" written by V. Belesslots was used as a guideline for calculating the Mass output of water per hour for this device. The Assumptions that were used in the analysis are as follows:

- Glass Cover Emissivity is equal to 1
- Surface Area of water and basin is equal to $1m^2$
- Angle of Incidence for Solar Still Cover is equal to 0.5 radians
- Optical Efficiency of Glass is equal to 0.8
- There is no heat loss through the sides of the still
- Depth of Water in Basin is 2cm
- Standard properties for Salt Water
- Standard properties for glass
- Convective heat transfer coefficient between glass over and environment was assumed to be $15W/m^2K$
- Convective heat transfer coefficient between water in basin and cover was assumed to be $5W/m^2K$

The Calculated values are listed below with the equations from the paper that were used:

Partial Water Vapor Pressure of Temperature range 10-150C:

$$p = 165{,}960.72\times10^{-[X(a+bX+cX^3)]/[T(1+dX)]} \quad \text{(A.12)}$$

where

$X = 647.27 - T$

$a = 3.2437814$

$b = 5.86826\times10^{-3}$

$c = 1.1702379\times10^{-8}$

$d = 2.1878452\times10^{-3}$

Latent Heat of Vaporization $h_{fg} = 3{,}044{,}205.5 - 1679.1109\,T_w - 1.14258\,T_w^2$ (A.11)

Sky Temperature $T_s = 0.0552\,T_a^{1.5}$ (A.10)

Radiative heat transfer coef. between glass over and environment

$$h_{rgs} = \varepsilon_g \sigma \left(T_g^2 + T_s^2\right)\left(T_g + T_s\right) \quad \text{(A.8)}$$

Evaporative heat transfer coef, between water in basin and cover

$$h_{ewg} = \frac{9.15\times10^{-7} h_{cwg}\left(p_w - p_g\right) h_{fg}}{\left(T_w - T_g\right)} \quad \text{(A.6)}$$

Radiative heat transfer coefficient between water in basin and cover

$$h_{rwg} = 0.9\sigma \left(T_w^2 + T_g^2\right)\left(T_w + T_g\right) \quad \text{(A.7)}$$

Calculating Overall upward heat flow factor:

$$U_t = \left[\frac{1}{U_i} + \frac{1}{A_r U_o}\right]^{-1} \quad \text{(A.1)}$$

where

$$U_i = h_{cwg} + h_{ewg} + h_{rwg} \quad \text{(A.2)}$$

$$U_o = \frac{h_w\left(T_g - T_a\right)}{T_g - T_s} + h_{rgs} \quad \text{(A.3)}$$

$$A_r = \frac{A_g}{A_w} \quad \text{(A.4)}$$

Calculating Mass Output

$$M_{out} = A_g \frac{h_{ewg}}{h_{fg}} \frac{U_t}{U_i} \Delta t\left(\bar{T}_{wd} - T_{ad}\right) \quad \text{(5)}$$

Calculating Incremental Water Temperature

$$\frac{C_w}{A_w}\frac{dT_w}{dt} = k(t)n_o I(t) - U_t\left[T_w(t) - T_a(t)\right] - U_b\left[T_w(t) - T_a(t)\right] \quad \text{(2)}$$

Simulation Using Theoretical Model:

Matlab was used to create the simulated model using the TMY3 data as the input. This is the reason for the variability in the results. Shown is the Hourly Calculations, Daily Calculations and a "typical" winter day vs. summer day plots:

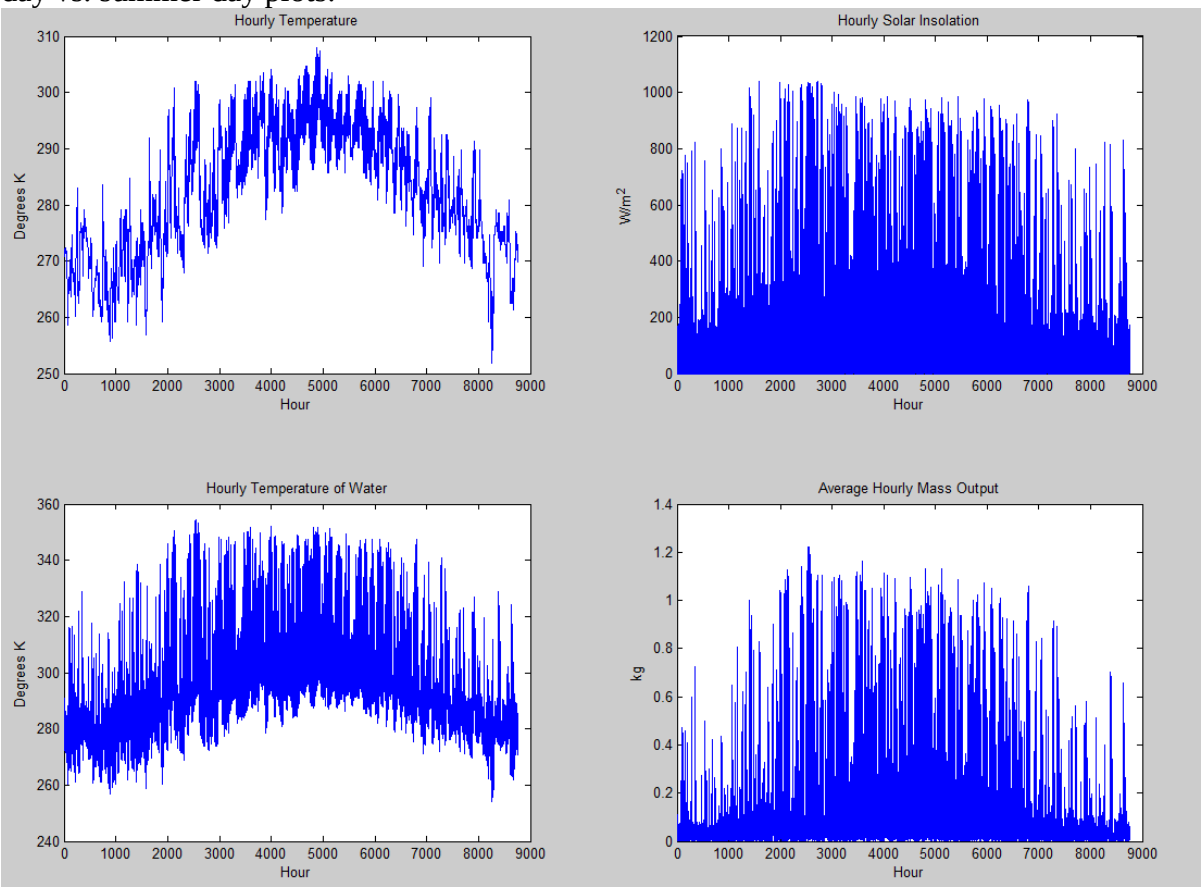


Figure 5. Matlab Simulations

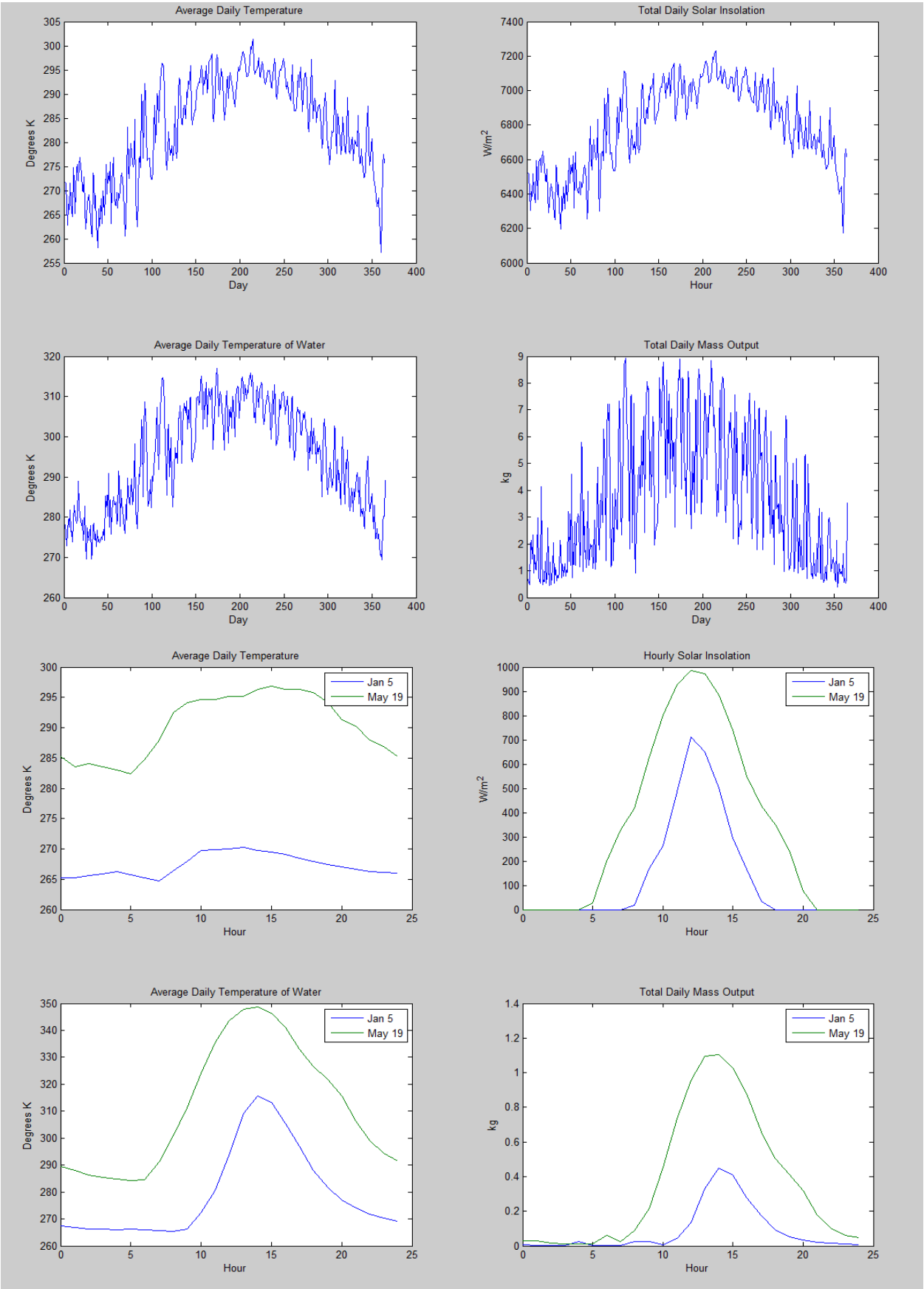


Figure 6. Matlab Simulations

The Following was calculated as reference and was taken from the command window after the simulation was run:

Average Mass Output per Day (kg)
3.6397

Mass Output Jan 5(kg)
2.1462

Mass Output May 19(kg)
9.0267

In order to answer some design questions the following was done using the theoretical model: The radiative heat loss was doubled in an effort to represent the heat loss through the sides of the solar still if LEXAN was used. Using LEXAN would provide the user with a clear view of the interworkings of the still. However, the major concern in using LEXAN is the radiative heat loss without having fully insulated sides. The area for both sides is approximately equal to the top of the solar still which is why the approach of doubling the radiative losses was taken. The results are shown below:

	From Orginal Analysis	Increase Radative Losses	Percent Difference
Average Mass Output per Day (kg)	3.6397	3.5309	2.99%

Table 1. Average Mass Output Per Day

Sensitivity Analysis:

The sensitivity analysis was completed to Validate the Assumptions for Heat Transfer Coefficents that were made for the theoretical model. For the heat transfer coeffiecients that were assumed constant, an upper bound and lower bound were created by varying the assumed value by 20%. The sinusodal fits created for daily temperature and daily insolation from the TMY3 data were used in order to better display the upper and lower bounds. The average daily mass output for the upper, lower and middle curves are also shown:

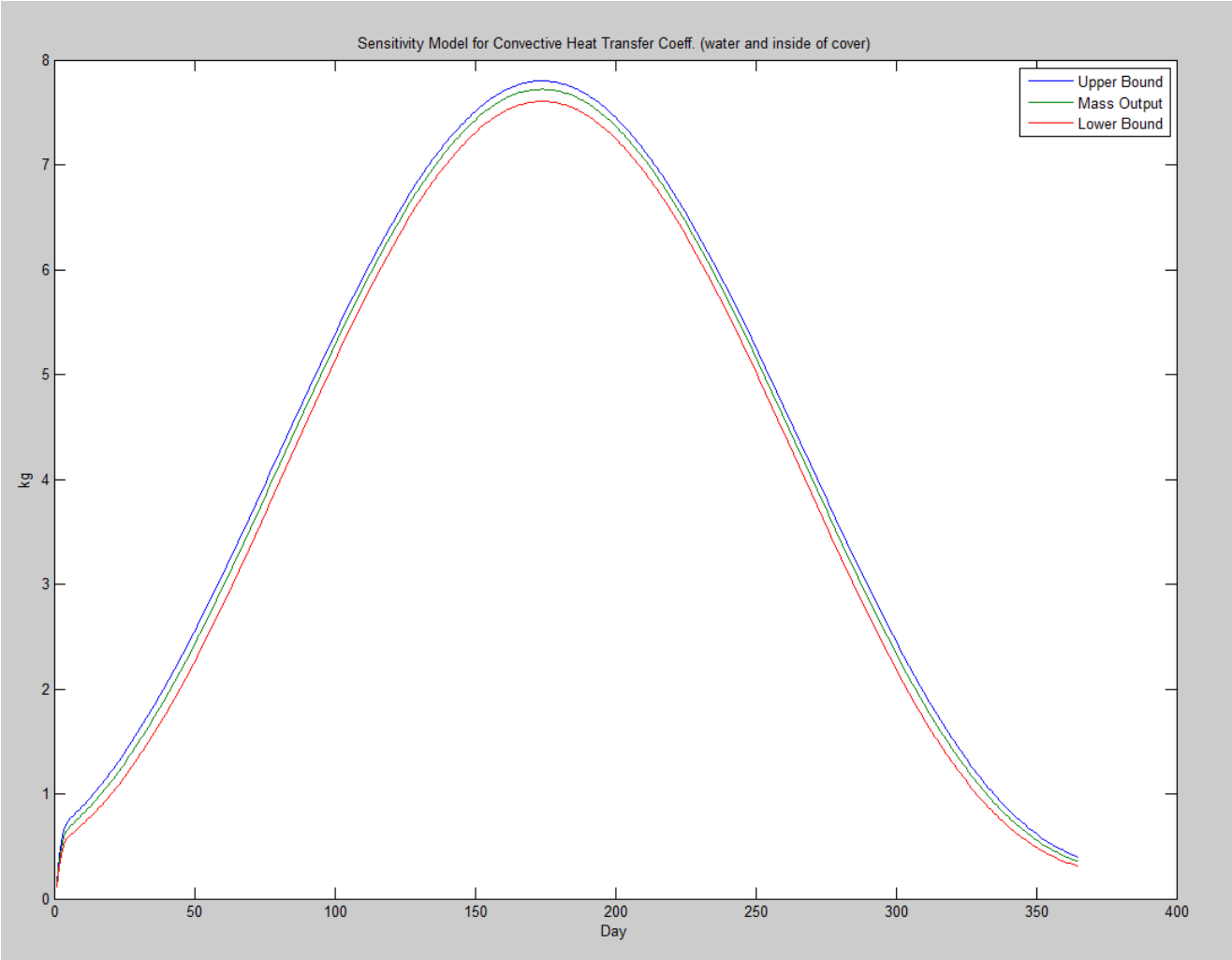


Figure 7. Sensitivity Analysis

Average Mass Output per Day Upper Bound (kg)

4.3194

Average Mass Output per Day (kg)

4.2251

Average Mass Output per Day Lower Bound (kg)

4.0956

Approximately a 3% change in Mass Output due to a 20% change in the Heat Transfer Coefficient between the water and the inside of the glass cover

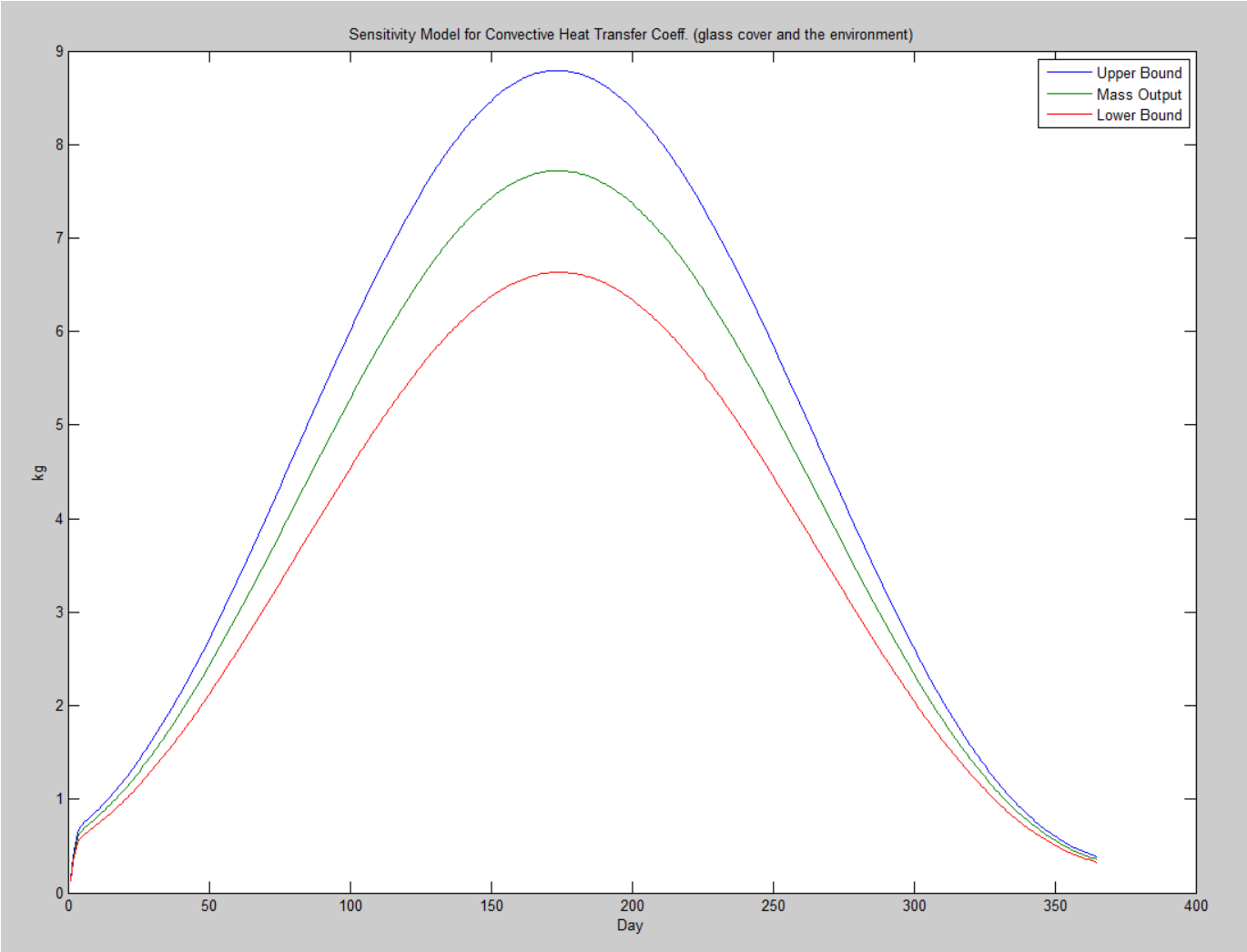


Figure 8. Sensitivity Analysis

Average Mass Output per Day Upper Bound (kg)
4.7867

Average Mass Output per Day (kg)
4.2251

Average Mass Output per Day Lower Bound (kg)
3.6487

Approximately a 13.5% change in Mass Output due to a 20% change in the Heat Transfer Coefficient between the glass cover and the environment

A sensitivity analysis was also completed for the glass emissivity value. The upper bound in this case is the assumed value (ideal value) the middle value is a typical emissivity value for glass and the lower bound was chosen in order to have an equal distribution from the center (or typical value).

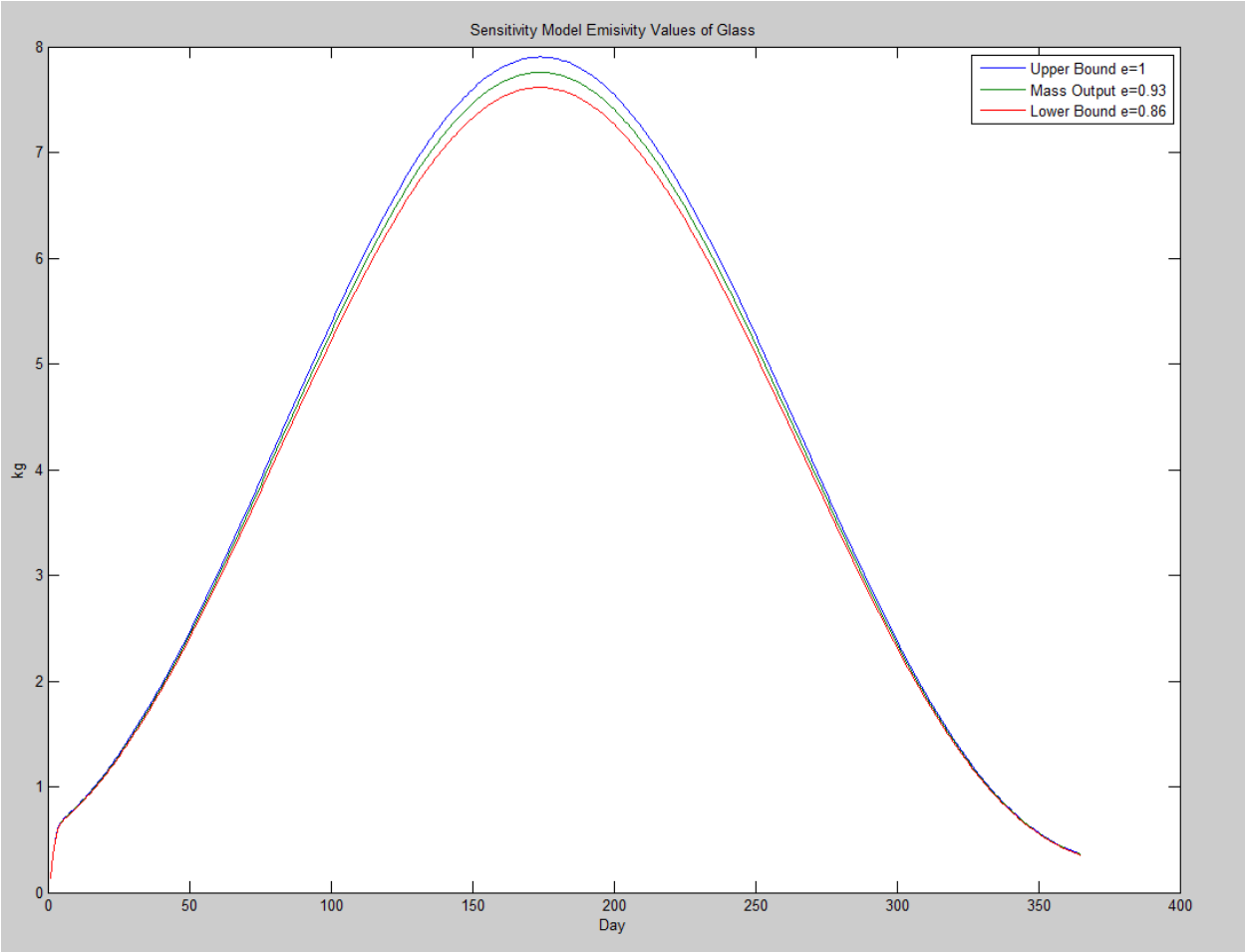


Figure 9. Sensitivity Analysis

Average Mass Output per Day Upper Bound (kg)
4.3145

Average Mass Output per Day (kg)
4.2435

Average Mass Output per Day Lower Bound (kg)
4.1723

Upper bound is only 1.6% larger than the average mass output per day for the typical emissivity value for glass. Meaning assuming the glass has an ideal emissivity value does not have a large effect on the overall output

NOTE: Using the fit line increases the Average Mass Output per day however, the sensitivity analysis was designed to provide a range for the expected average mass output depending on the parameter that is changed.

Compound Parabolic Collector

Theoretical Model of a Concentrating Parabolic Collector (FPC) with a Thermosiphon.

Assumptions

- Quasi steady state
- No shading
- Ideal flow (laminar, 1D, uniform)
- Hottel Whillier Bliss equation (linearized heat loss)
- Conditions from receiver to receiver are the same

Calculations

The model was developed based on the following equations for a thermosyphon FPC from the Zerrouki paper used.

$$\varphi = N\frac{L_c}{L_{ct}}\left(\frac{d_c}{d_{ct}}\right)^4 \tag{15}$$

$$C = \frac{gN\pi A_c d_c^4\left(\frac{L_c \sin\theta}{2} + H\right)}{128 L_c(1 + \varphi)} \tag{22}$$

$$\dot{M} = C^{1/2}\left(\frac{\rho_o \beta}{\nu C_p}F'[I(\tau\alpha) - U_L(T_m - T_{amb})]\right)^{1/2} \tag{21}$$

$$T_o - T_i = \frac{A_c F'}{\dot{M} C_p}[I(\tau\alpha) - U_L(T_m - T_{amb})] \tag{19}$$

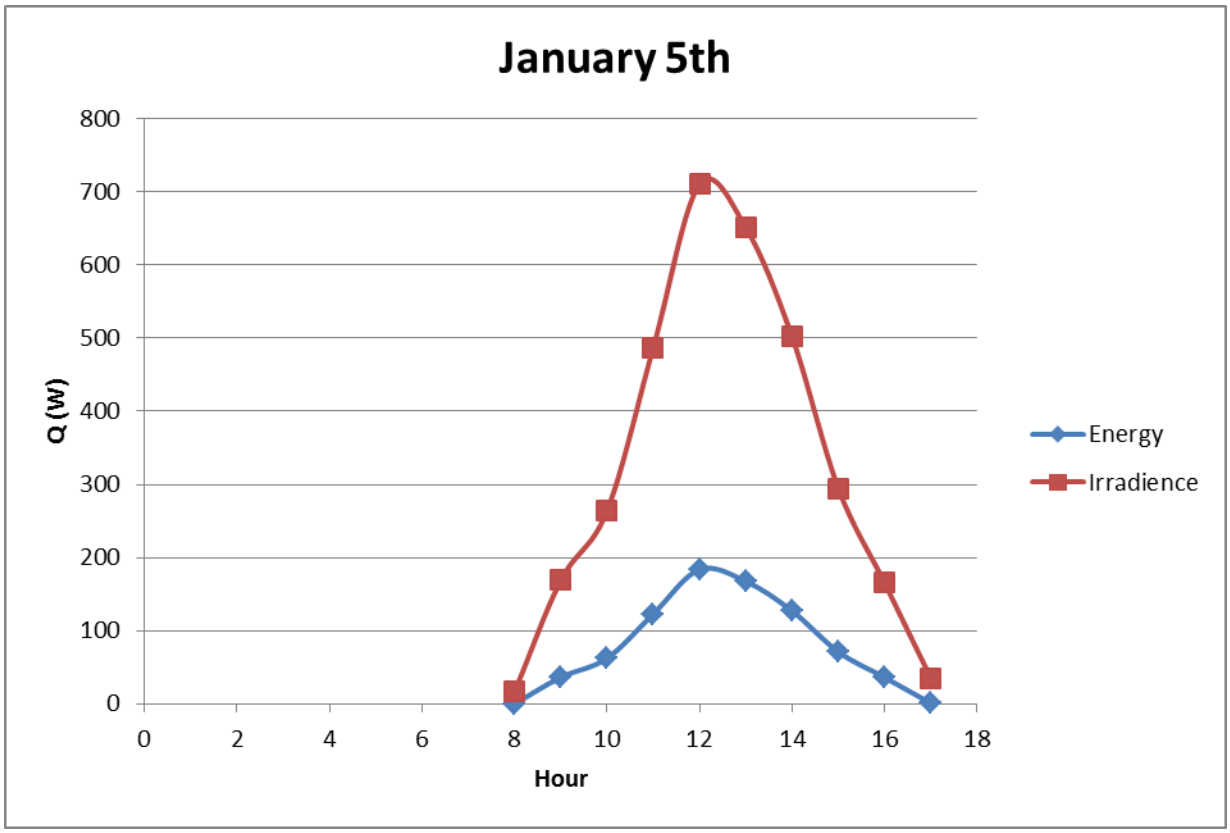
The following basic energy equation was used to find the energy into the fluid

$Q = \dot{m} * C_p * N * \Delta T$

Equations for relating a CPC collector to the Hottel Whillier Bliss equation were taken from Solar Engineering of Thermal Processes 3rd edition.

Sample Days

Using the model developed we predicted the energy added to the system for January 5th and June 5th resulting in the following plots.



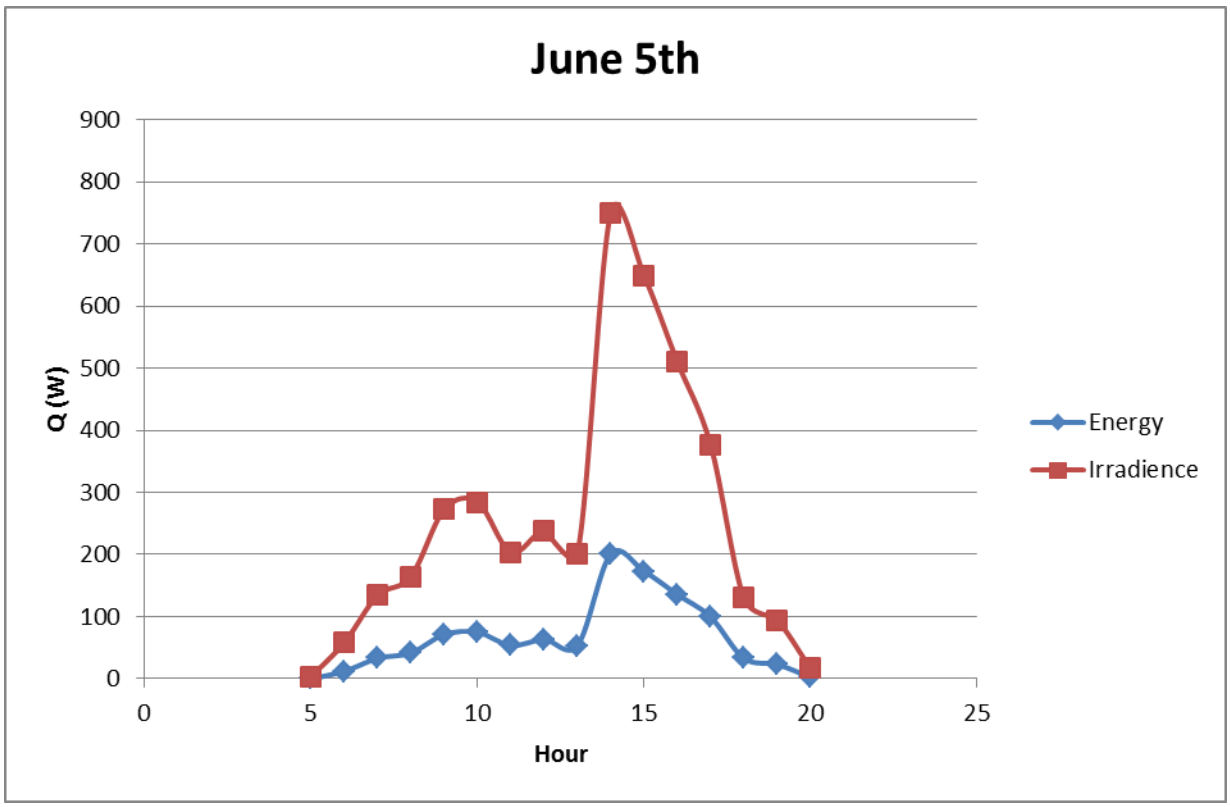


Figure 10. Energy and Irradiance for January 5th and June 5th (CPC)

Conclusion

Date	5 January	5 June
Total Daily Irradiance (W)	3,675	4,557
Total Energy Input to Still (W)	808.5	1070.5
Efficiency	22%	23%

Table 2. Comparison of Jan.5 and Jun. 5 (CPC)

Using this model we predict a usable energy input to the solar still even during the winter in Rochester. The efficiency over the year stays somewhat constant.

Flat Plate Collector

Theoretical Model of Flat Plate Collector (FPC) with a Thermosiphon

Assumptions

- Quasi stead state
- No shading
- Ideal flow (laminar, 1D, uniform)
- Hottel Whillier Bliss equation

Calculations

The model was developed based on the following equations for a thermosiphon FPC from the paper used.

$$\varphi = N\frac{L_c}{L_{ct}}\left(\frac{d_c}{d_{ct}}\right)^4 \tag{15}$$

$$C = \frac{gN\pi A_c d_c^4\left(\frac{L_c \sin\theta}{2} + H\right)}{128 L_c(1+\varphi)} \tag{22}$$

$$\dot{M} = C^{1/2}\left(\frac{\rho_o \beta}{\nu C_p}F'[I(\tau\alpha) - U_L(T_m - T_{amb})]\right)^{1/2} \tag{21}$$

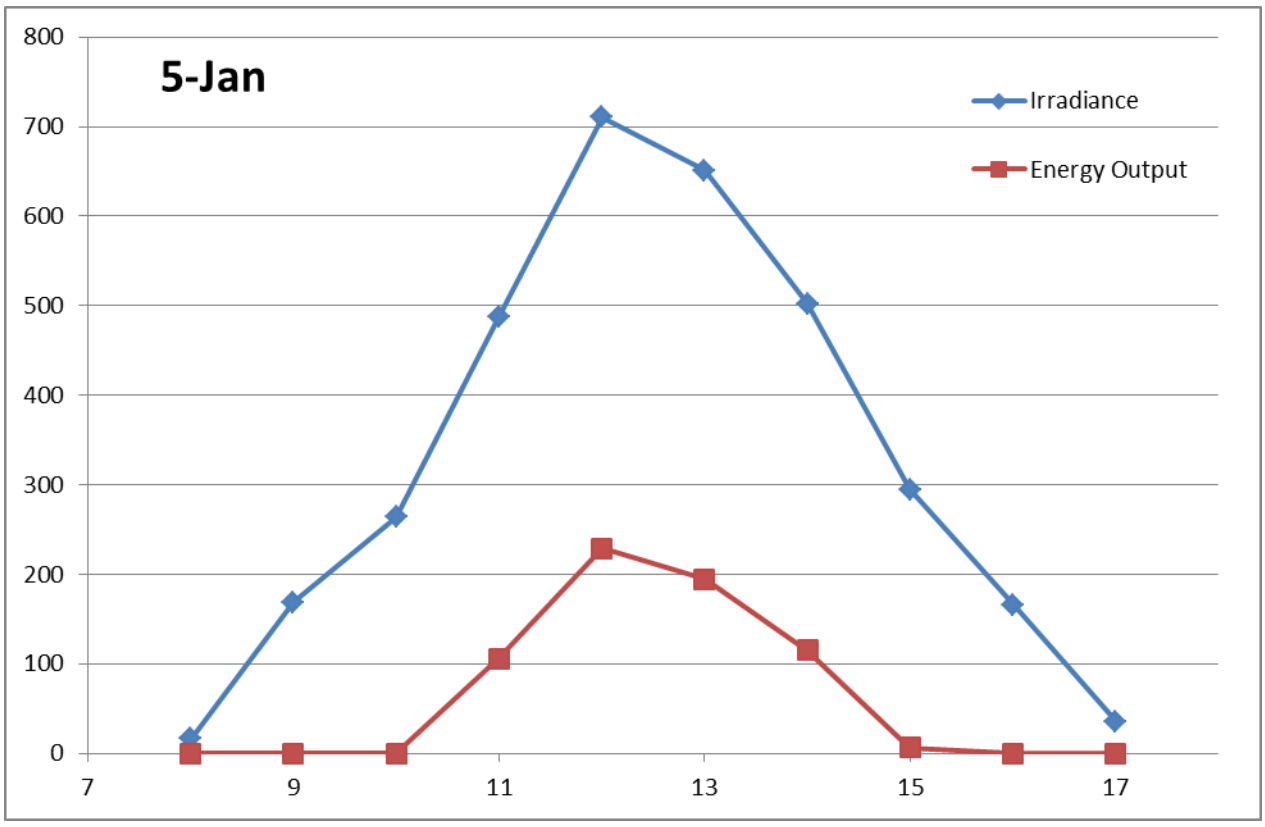
$$T_o - T_i = \frac{A_c F'}{\dot{M} C_p}[I(\tau\alpha) - U_L(T_m - T_{amb})] \tag{19}$$

The following basic energy equation was used to find the energy into the fluid

$Q = \dot{m} * C_p * N * \Delta T$

Sample Days

Using the model developed we predicted the energy added to the system for January 5th and June 5th resulting in the following plots.



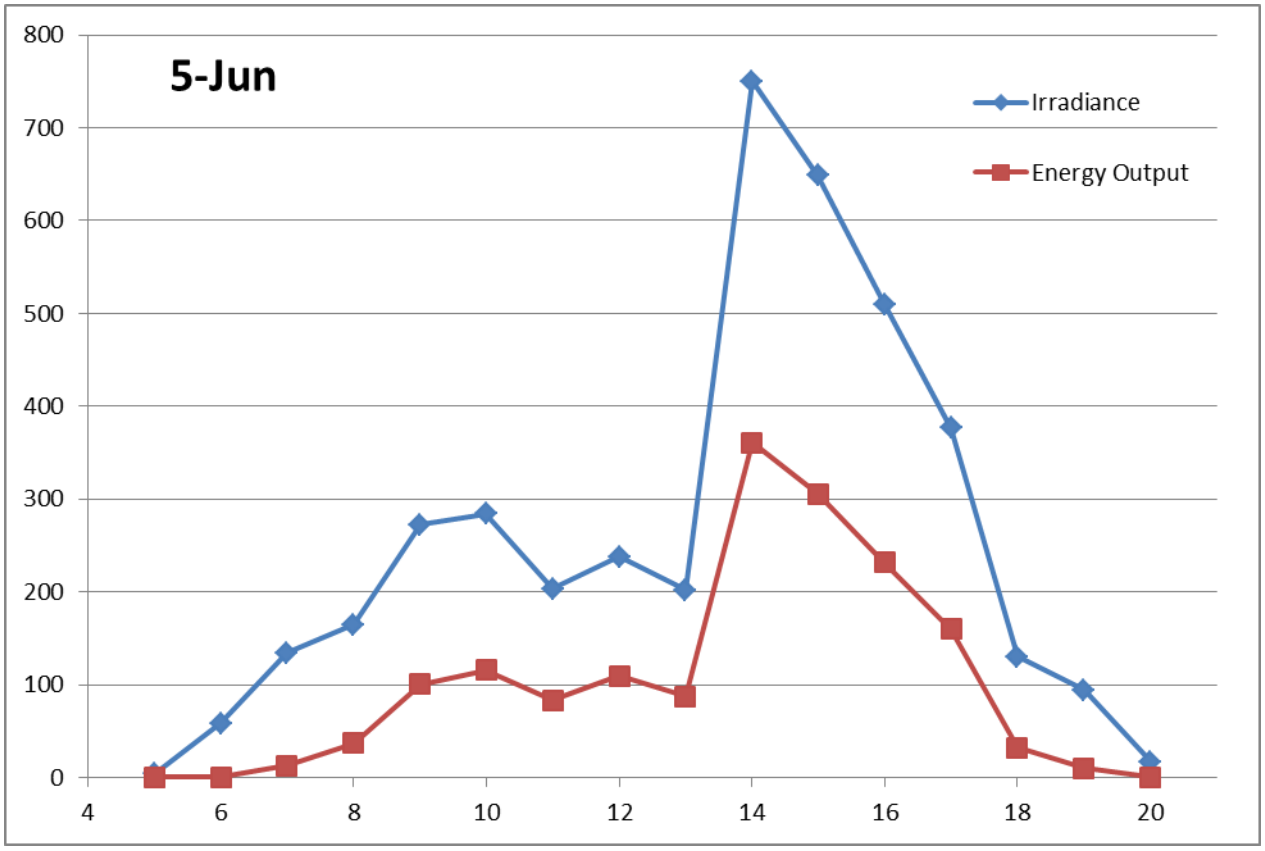


Figure 11. Energy and Irradiance for January 5th and June 5th (FPC)

Conclusion

Date	5 January	5 June
Total Daily Irradiance (W)	3,675	4,557
Total Energy Input to Still (W)	651	1,646
Efficiency	17.7%	36.1%

Table 2. Comparison of Jan.5 and Jun. 5 (FPC)

Using this model we predict a usable energy input to the solar still even during the winter in Rochester. The efficiency decreases, but the overall collector provides an acceptable amount of usable energy.

System Specifications

	Separate Water from Contaminants		Remove Useable Water and Wastewater		Effective Student Interface			Effectively Measure & Control System					Input Water	
Engineering Specifcation Number	a.1	a.3	b.1	b.2	c.1	c.2	c.3	d.1	d.3	d.4	d.5	d.6	e.1	e.2
Engineering Specifcation Description	Reduce Salt Content	Harness Renewable Resource	Remove Useable Water	Remove Waste	Effectively demonstrate engineering principles	Intuitive to operate system	Operate Safely	Measure Salinity	Control Water Input	Measure Temperature	Measure Pressure	Measure Supply Level	Input water from unuseable wate source	Guarantee water supply to system
Measure of Performance	% Salinity	% Power Used from Renewables	ml/min	Days between cleaning (days)	Theoretical Models Used	# Hrs Training Required	# Hazards	Accuracy (uS/cm)	Accuracy of height of water in Still (cm)	Accuracy (°C)	Accuracy (% of scale)	Accuracy of water height in storage tank (cm)	Maintain water level (cm)	Maintain Volume in Storage Tank (Liters)
Preferred Direction	Down	Up	Up	Up	Up	Down	Down	Up	Up	Up	Up	Up	Target	Target
Nominal Value	0.01	100	21	7	5	1	0	1	0.25	0.1	0.5	0.5	2	6
Marginal Value	.05-.1	60	3.5	1	2	2	3	50	1	1	2	2	+/- 1	8-10

Figure 12. System Specifications

System Design Diagram

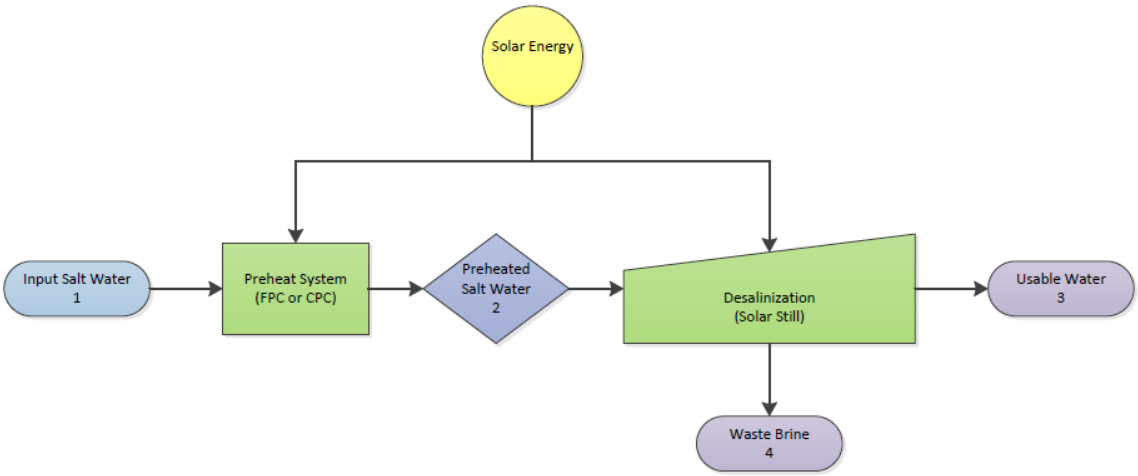


Figure 13. System Design Diagram

Design CAD Drawings and Schematics (Overview of the proposed design with detailed presentation during the review)

Solar Still

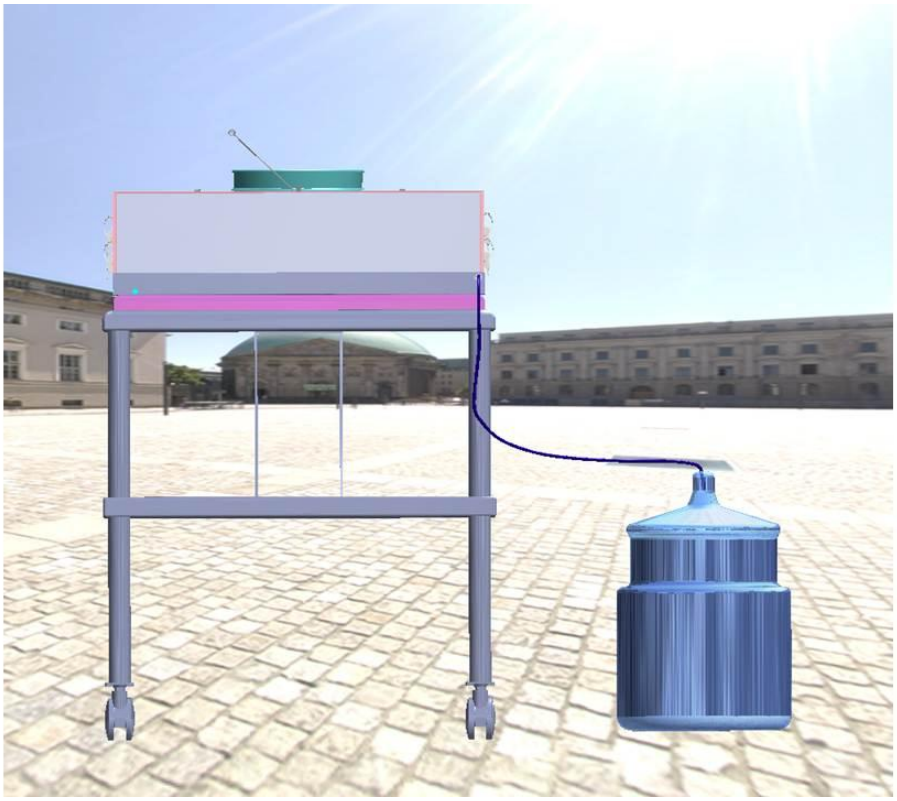


Figure 14. Front Solar Still

Figure 15. Side Solar Still

Figure 16. Rear Solar Still

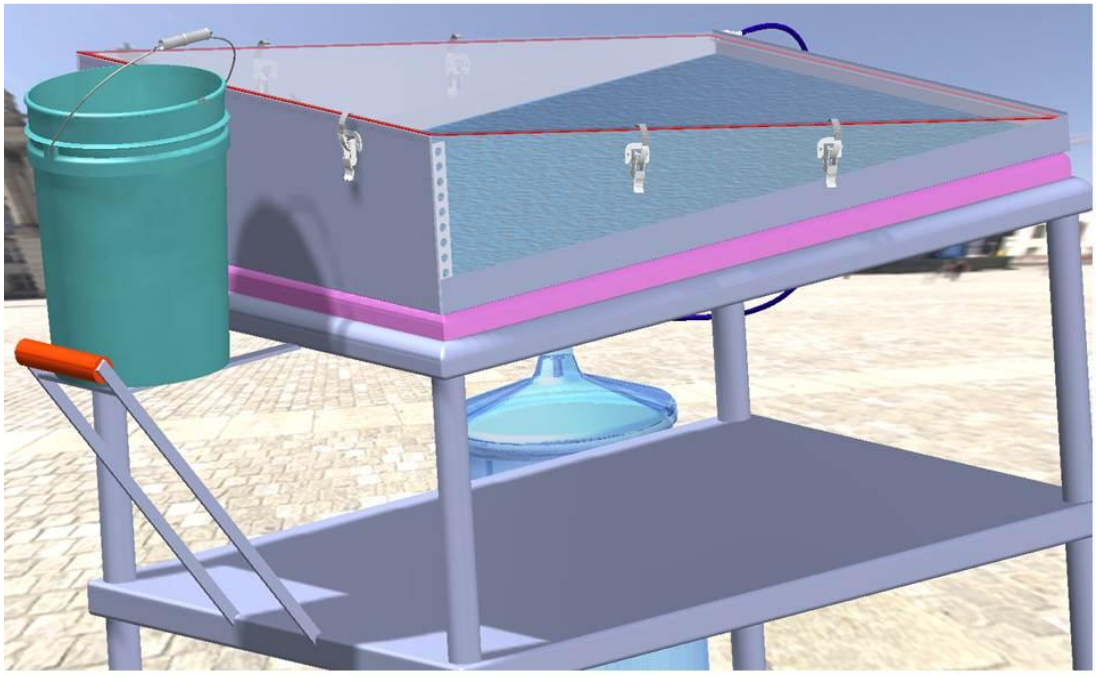
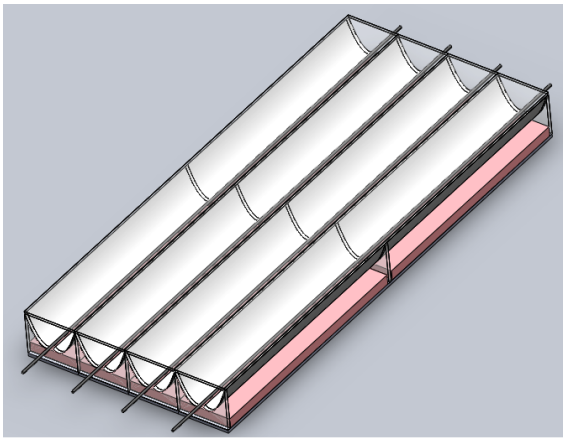


Figure 17. Angle Solar Still

Compound Parabolic Collector (CPC)



Pros:

-Higher concentration ratio

-More interesting lab model

-Can achieve higher temps

Cons:

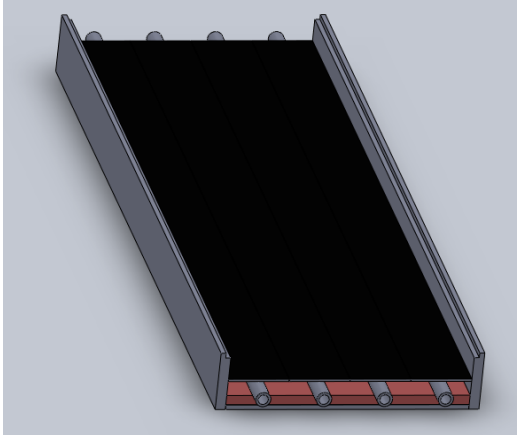
-More complicated design

-More labor required to build

-More risk

-Small acceptance angle (~30 deg)

Flat Plate Collector (FPC)



Pros:

-Fairly simple design

-Less risk

-Large acceptance angle (~180 deg)

Cons:

-Less interesting lab model

Compound Parabolic Collector

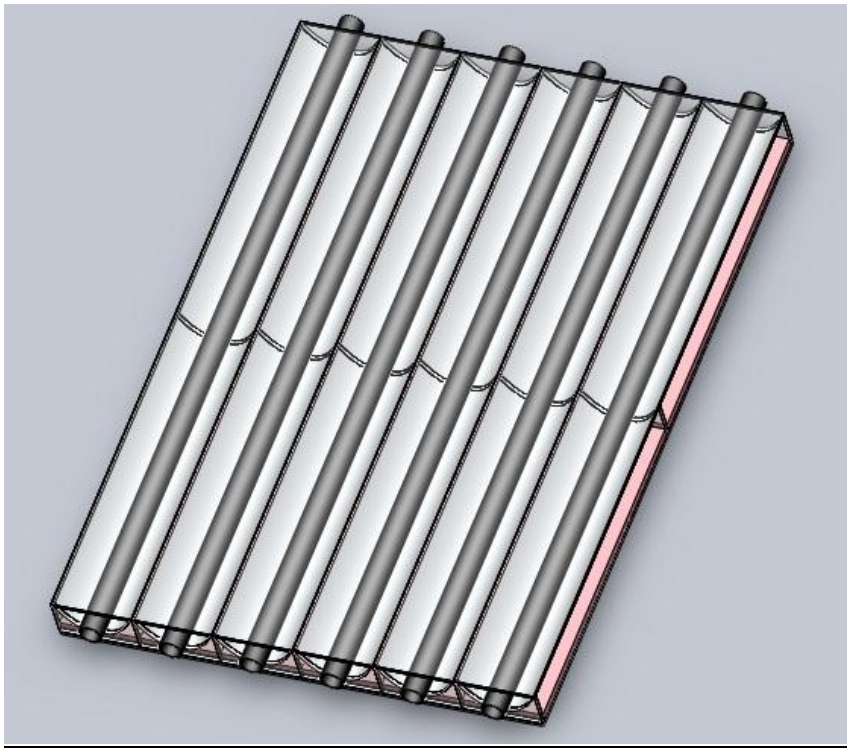


Figure 18. Compound Parabolic Collector

Flat Plate Collector

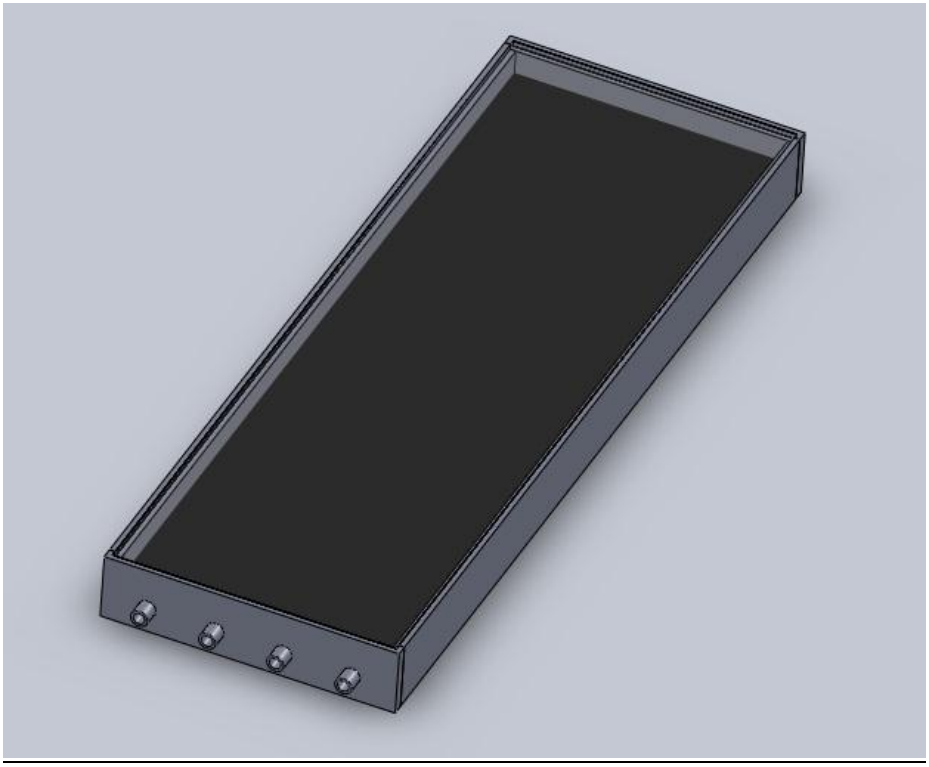


Figure 19. Flat Plate Collector

P11411 - Testing Plan

Objective:

The objective of this test plan is to develop an accurate and functioning desalination unit using renewable energy sources. This will be defined by the successfully completion of each of the three tests listed below and the defined engineering specifications for the device. By completing this testing plan the device will quantifiably be defined as accurate and functioning. All tests must be completed under the standard testing conditions (see Appendix: Standard Testing Conditions). Overall this test plan calls for 10 days of testing.

System Test:

Objective:

This test is designed to test that all components of the system are operating correctly. After the system is finally assembled this first test will allow for any flaws to be revealed prior to the major testing. By testing the physical system without any of specifications in mind it will allow for the engineers to focus on each component of the design and make sure it is functioning properly. If at the end of the procedure any component is still not achieving its required functionality, then that component must be redesigned and the Systems Test should be repeated after the new component is installed.

Outline:

This test will be completed twice prior to the Specifications Test beginning; therefore no measurements are required to be taken.
Each mechanical component of the design will be observed during testing. The performance will be rated as Satisfactory or Poor. Any components ranked Poor during the first test will be adjusted by the engineers before the second test.
The second test will be run after all required adjustments are made. Each component again will be ranked during the testing. Any components ranked Poor will have to be redesigned by the engineers.

Documentation:

A list name every component on the device will be created. This list will be put into a table and for each test the components ranking will be placed next to it. Every component must be ranked for each of the two tests.

Component	Test 1 Ranking	Test 2 Ranking

Timeline:

Each test should take approximately four to eight hours to complete (depending on design). At least one day must be given between the two tests for any components that were ranked Poor to be adjusted.

Data Acquisition Test:

Objective:
The goal of the data acquisition test is to verify that all devices which measure/record data are functioning properly before and after they are installed on the system. These devices include, but are not limited to, flow meters, thermometers, salinity measuring devices and manometer.

Outline:
Prior to all measuring devices being installed, each device will be tested with a control. The device must be installed to the data collection device that is installed to a computer. This will verify that the devices is reading properly as well as installed to the computer system correctly. An example of this would be using a thermocouple to measure the temperature of a room that has a known temperature.
All devices will then be installed to the system and tested again. If there is some discrepancy between the initial test value and the new test value calibration may be necessary for that particular device

Documentation:
Each device will be listed, and will be labeled either "Pass" or "Fail" for each of the two tests. If any devices fail the test, the team will decide if the test should be run again or if a new device is needed to replace the current, non-functioning one.

Measuring Device	Test 1 (Prior to Installation)	Test 2 (Post Installation)

Timeline:
This process should take approximately 1 day in its entirety. If major problems are encountered (devices are not operating properly) this may take longer if a new one has to be delivered.

Specifications Test:

Objective:
This test will be the most intensive and require the most amount of time because it will determine the nominal values for each specification. Using the defined engineering specifications the device will operate for a typical day time period and all specifications will be measured and recorded. This test will be re-run until all engineering specifications are satisfied.

Outline:
The system will be run for the daytime period after all measurement and control devices are installed.
Using these controls all required measurements for each specification will be taken.
This value will then be ranked using the following scale:

Above Nominal (Better than the Target Value)
Nominal (The Target Value)
Marginal (In Acceptable Value Range)
Below Marginal (Unacceptable Value, Specification not met)

Any specification that receives a "Below Marginal" ranking the system will be evaluated by the engineers and a **Plan of Action** will be filled out by the team. This plan will then be executed and the specifications test will be run again after the system is fixed.
The specifications test must be run at least three times and documented to validate that all results are consistent.

Documentation:

Each engineering specification will be listed as well as the Nominal and Marginal values for that specification (see VOE Nom-Marg Values on Google Docs). There will then be a space for recording the test results for the specification and the proper rank next to it. This will be done for each of the tests and save in one document.

Specification	Nominal Value	Marginal Value	Ranking for T1	Ranking for T2	Ranking for T3

Timeline:

This test requires at least three full days of testing. This does not include any issues that are encountered (larger or small). A safe estimate is that this testing will take 6 days to complete.

Appendix: Standard Testing Conditions:

To demonstrate the system functionality the following are the parameters that will be used in order to do so:

- Input water salinity: 35,000 - 40,000 ppm
- Input water temperature:13C (+/- 1C)
- Testing will be completed on a Mostly Sunny to Completely Sunny day.

Each of the tests specified above MUST be run under these lab conditions in order to verify that the system meets the customers' needs and the engineering specifications.

Plan of Action

Date:_____
Documented By:_____

Description of Problem:

Please place the description of what is not working properly here

Cause of the Problem:

Please place the reason for this problem here; the reason should be determined using the following flow chart. This ensures that the root cause of the problem is identified.

Team Ideas to Resolve this Problem:

TEAM brainstorms Ideas on how this problem can be resolved. After all ideas are on the table (brainstorm complete) then the team will rank each idea on how well it will work, how quickly it will get done, and overall impact to the design.

Final Resolution:

The team will make a choice on what will be the best course of action based on the ranking above. All members must agree and move forward.

Action Items:

Item	Owner	Date Assigned	Date of Completion

Signed By

Sergey Chiripko _____Date: _____

Wayne Evans _____Date: _____

Allie Schneider _____Date: _____

Andy Thistle _____Date: _____

Dylan Connole _____Date: _____

Kelsey McConnaghy _____Date: _____

Gerald Garavuso _____Date: _____

Bill of Materials (Turned sideways to fit on this page)

Part Description	Material	Distributor	Distributor Part #	Quantity Required	Quantity Ordered	Unit Price	Total Price	Lead Time	Responsible (Owner)	Status	Comments
Solar Still Sub-System											
Solar Glass (Low Iron Tempered), 34" x 96"	Glass	Thermo-Dynamics LTD	GL-24	1		$181.00	$181.00	4 Weeks	Sergey		
Aluminum 6061-T6 Bare Sheet, PVC 1 side, 0.032" thick, 36" x 48"	Aluminum	OnlineMetals.com	Not Specified	2		$32.77	$65.54	2 Weeks	Sergey		
LEXAN Polycarbonate Sheet, 72" x 36"	Polycarbonate	Home Depot	Store SKU # 298017	1		$99.97	$99.97	0	Sergey		
5/32" Washer (Fluorosilicone)	Rubber	McMaster-Carr	91367A903	1		$7.60	$7.60	3 Weeks	Sergey		
Sealant/Caulking (2.8oz tube)	Silicon	McMaster-Carr	7545A451	1		$4.29	$4.29	3 Weeks	Sergey		
Aluminum 6061-T6 Bare Extruded Angle, 1" x 1" x 0.125", 24" long	Aluminum	OnlineMetals.com	Not Specified	1		$2.63	$2.63	2 Weeks	Sergey		
Quick-Disconnect Tube Couplings	Plastic	McMaster-Carr	5012K632	2		$14.86	$29.72	3 Weeks	Sergey		
Mini Adjustable Float Valve, 1/4" ID	Plastic	FreshWaterSystems.com	FVMA-B22	1		$10.98	$10.98	2 Weeks	Sergey		
Closed Cell Foam, 1.7 Lb Density, 1" Thick, 108" x 24"	Polyethylene	TheFoamFactory	PE17-1H-WH	1		$32.99	$32.99	2 Weeks	Sergey		
Draw Latches, 1 31/64", Zinc-Plated	Steel	McMaster-Carr	1863A21	6		$5.73	$34.38	3 Weeks	Sergey		
Tropic Marin Sea Salt 50 Gallon Mix	Salt	Aquarium Specialty	ATM10222	1		$18.90	$18.90	2 Weeks	Sergey		
Cap Screws, 1/4"-20, 3/4" Length, Pack of 10	Stainless Steel	McMaster-Carr	92245A540	1		$6.74	$6.74	3 Weeks	Sergey		
Cap Screws, 1/4"-20, 2 3/4" Length, Pack of 25	Steel	McMaster-Carr	91309A553	1		$4.51	$4.51	3 Weeks	Sergey		
Cap Screws, M12, 20 mm Length, Pack of 10	Stainless Steel	McMaster-Carr	91287A187	1		$8.60	$8.60	3 Weeks	Sergey		
22 - Red SBR Rubber Sheet (Custom Cut Gasket), 1/16" thick	SBR Rubber	Garlock Sealing Technologies	Not Specified	1				1 Week	Wayne		Free (Wayne will be working for Garlock)
Rust-Oleum Stops Rust 12 oz. Protective Enamel Spray Paint	Paint	Home Depot	Store SKU # 801447	1		$4.67	$4.67	0	Sergey		
5-Gallon Bucket	Plastic	Lowes	Store SKU # 4853	1		$2.54	$2.54	0	Sergey		
All Purpose Utility Cart	Metal	Target	B0002O9HXU	1		$109.99	$109.99	0	Kelsey		
Solar Still Sub-System Total:							$625.05				
Compound Parabolic Collector											
Backboard	OSB	Lowes	Store SKU # 12217	1		14.87	$14.87	0	Sergey		
Foam Board Insulation	LD PE	Lowes	Store SKU # 201549	1		11.41	$11.41	0	Sergey		
Brackets	Acrylic	Rochester Glass	See CPC model	-		-	$25.00	3 weeks	Sergey		
Reflective Trough	Aluminum	McMaster-Carr	See CPC model	-		-	$132.09	3 days	Sergey		
Receiver Pipe	Copper	McMaster-Carr	See CPC model	-		-	$85.00	3 Weeks	Sergey		
PVC Pipe 10'	PVC	Lowes	Store SKU # 23830	1		4.1	$4.10	0	Sergey		
PVC Fittings	PVC	Lowes	Msc	-		-	$10.00	0	Sergey		
Pipe Insulation	LD PE	Lowes	Store SKU # 24434	2		1.26	$2.52	0	Sergey		
Compound Parabolic Collector Total:							$284.99				
Flat Panel Collector											
Housing Case, 0.024" x 36" x 48" Sheet	Stainless Steel	McMaster-Carr	8983K41	2		$56.95	$113.90	3 Weeks	Sergey		
Collector Back Insulation, 2" x 48", 10 Feet Vinyl Faced Sheet	Fiberglass	McMaster-Carr	9330K82	1		$39.99	$39.99	3 Weeks	Sergey		
Receiver Tube, 1/4" OD	Copper	McMaster-Carr	8965K86	6		$17.08	$102.48	3 Weeks	Sergey		
Absorber Fins, 0.04" x 36" x 24" Sheet	Aluminum	McMaster-Carr	8973K65	2		$24.86	$49.72	3 Weeks	Sergey		
Pipe Insulation, 1" ID, 1" Thick, 3 Feet sections	Foam	McMaster-Carr	5431K15	2		$10.57	$21.14	3 Weeks	Sergey		
Pipe Insulation, 1" ID, 1" thick, Bend	Foam	McMaster-Carr	9097T12	4		$6.45	$25.80	3 Weeks	Sergey		
Sealant/Caulking (2.8oz tube)	Silicon	McMaster-Carr	7545A451	1		$4.29	$4.29	3 Weeks	Sergey		
Flat Panel Collector Total:							$357.32				
Solar Still and Compound Parabolic Collector Total:							$910.04				
Solar Still and Flat Panel Collector Total:							$982.37				

Updated Risk Assessment

MSD Project Risk Assessment Template

ID	Risk Item	Effect	Cause	Likelihood	Severity	Importance	Action to Minimize Risk	Owner
	Describe the risk briefly	*What is the effect on any or all of the project deliverables if the cause actually happens?*	*What are the possible cause(s) of this risk?*			*L*S*	*What action(s) will you take (and by when) to prevent, reduce the impact of, or transfer the risk of this occurring?*	*Who is responsible for following through on mitigation?*
1	Losing a team member	Work reallotted, knowledge lost, less man hours	Arrest (deportation), Leave of absence, Emergency, team conflict	1	3	3	Detect conflict and lack of integrity early on, use a third party mediator and personal counsel to mitigate. -dynamic	Team
2	International logistics (miscommunication)	Missed deadlines, misinterpretations Lack of communication Few overlapping work hours	Skype malfunction, e-mail malfunction, failure to inform others, physical distance, shipping time, customs, time zones	3	2.5	7.5	Skype meetings conducted on campus with meeting notes recorded in duplicate and e-mailed for validation. Agenda for each meeting sent out prior to meeting date for review. Staying on task to reduce confusion. Mondays	Team Leader (Sergey)
3	Miscalculations	Unacceptable deliverables, failure to produce working demo unit, hardware and safety issues, more time consumed	Sleep deprivation, unit conversion, negligence, rushing, invalid assumptions, invalid models	2	3	6	Have work checked by peer on team. Always work in metric units(and $). Take your time. Validate models/ensure realistic results. Prioritize and plan to avoid rushed work. –Dynamic	Team
4	Over budget	Incomplete demo unit, increased man hours, system redesign	Expense of solar collector, oversized system, salt resistant components, consumables, outsourcing costs	1	3	3	Assign a treasurer position to be elected next meeting. Their tasks will include keeping a detailed budget as well as tracking and planning expenditures. -1-10-11	Treasurer
5	Under sizing system	Nonfunctioning demo unit, inefficient system	Miscalculations, over budget	1	3	3	Model system –MSD 2 Incorporate factor of safety	Team
6	Weather fluctuations	Demonstration limited/ineffective	Clouds, location, solar eclipse, seasons	3	2	6	Review weather forecast, Multiple test dates , solar lamps if necessary– demo day	Team
7	Limited demo usability	Project mothballed after completion, minimal student interaction	Lack of human interface, lack of explanation, under sizing, material choice(lack of transparent materials), transportability	2	2	4	Incorporate user friendly interface, dynamic data displays, short warm up time	RIT Dubai
8	System Integration malfunction	Demo unit fails, safety hazard, inaccurate data logging	Negligence, component incompatibility, tolerances, miscalibration	1	3	3	Test unit thoroughly prior to demo. Purchase compatible components. -MSD 2	Team
9	Availability of specific hardware	Increased man hours due to producing our own components, delays in delivered components	Location, technicality of project, material choices, vendor stock, cost	2	2	4	Use OEM components, order special items early on.	Team/Treasurer
10	Vendor lead time	Delays in delivered components, incomplete system	Cost, location, business hours, malfunctioning component	1	2	2	Use stock parts, order special items early on, test components on arrival.	Team
11	Component requires redesign	Delayed testing, man hours, material	Test Failure	3	2	6	Communication, units, good models, handle components with care	Team
12	Testing takes longer than expected	Missing deadlines, rushed work	Error source unclear, Repeated test failures, inconsistent outputs, complicated code	2	2	4	Efficiently schedule testing, attack problems quickly, be conscious of deadlines, allot enough time for testing.	Team
13	Models are not accurate	System design off, system redesign	Errors in sources, errors in code, misinterpretations, incorrect/ overgeneralized assumptions	1.5	3	4.5	Check others work, annotate code, check sources, reality check, check assumptions.	Team

14	Poor lab procedures	Unable to complete lab, inaccurate & inconsistent results produced, safety hazard	Instruction missing, directions too complicated for users with limited knowledge, mislabeled unit, unorganized directions.	1	2	2	Do test run for run by the directions once system is working (can be performed by someone outside the group). Have group check over all instructions and labeling. Neatly labeled components.	Team
15	Fail to meet Imagine RIT deadline	Loss of test opportunity, loss of potential project publicity and networking.	Testing and building take longer than expected, delay in parts arriving	1.5	1	1.5	Organized and efficient testing early in the quarter.	Team
16	Poor training procedures	Nobody knows how to use the system, time wasted by people trying to re-learn how it works. It gets moth balled instead of used.	Poor or no training procedure leads to lack of knowledge about system after team graduates.	1	2	2	Clear detailed and succinct instructions for operators, instructors, and TAs.	Team

Likelihood scale	**Severity scale**
1 - This cause is unlikely to happen	1 - The impact on the project is very minor. We will still meet deliverables on time and within budget, but it will cause extra work
2 - This cause could conceivably happen	2 - The impact on the project is noticeable. We will deliver reduced functionality, go over budget, or fail to meet some of our Engineering Specifications.
3 - This cause is very likely to happen	3 - The impact on the project is severe. We will not be able to deliver, or what we deliver will not meet the customer's needs.

"Importance Score" (Likelihood x Severity) – use this to guide your preference for a risk management strategy	
Prevent	Action will be taken to prevent the cause(s) from occurring in the first place.
Reduce	Action will be taken to reduce the likelihood of the cause and/or the severity of the effect on the project, should the cause occur
Transfer	Action will be taken to transfer the risk to something else. Insurance is an example of this. You purchase an insurance policy that contractually binds an insurance company to pay for your loss in the event of accident. This transfers the financial consequences of the accident to someone else. Your car is still a wreck, of course.
Accept	Low importance risks may not justify any action at all. If they happen, you simply accept the consequences.

Multicultural Preparation

Personal Responsibility:

Before Leaving

- ☐ Pre-departure meeting
  - Senior Design group members, guide, and Dr. Hensel
  - Study abroad students
- ☐ Download software before departure
  - Tortoise and set up project folder for group (test set-up)
  - RIT VPN address
  - Skype
    - Accept group members and faculty
    - Bring mobile microphone(if possible)
    - Confirm mic and video functionality
  - MATLAB and Solidworks (if possible)
- ☐ All members must have a Google email account (g-mail)
  - Link members Google calendars
    - Abroad members must change their calendars time zone
  - Share documents through Google docs
- ☐ Confirm MyCourses access to MSD documents
  - Confirm video and PowerPoint access to MSD lectures

Ongoing

- ☐ Copy all group members on all MSD related emails
- ☐ Acknowledge emails
- ☐ Use thumbs up to signal understanding in Skype meetings
- ☐ Upload files a day or two before meetings
- ☐ Update Tortoise project folder every time before opening
- ☐ Check e-mails at least twice daily (early in the morning and late evenings)

RIT & Dubai Faculty Responsibility:

For MSD Team:

- Set up faculty guide in Dubai for MSDI & MSDII
- Set up video conferencing equipped room
  - Get "real time" screen sharing using smart boards
  - At least two smart boards in a room for presentation purposes
- Create purchasing procedure for supplies
  - Include procedure for taxi reimbursement
- Schedule appropriate classes earlier (before 5pm) in Dubai and later in Rochester (not before 11am)
- Manually add Dubai members into same MSD class as Rochester students on MyCourses
- Reserve room for MSD class time/meetings
- Ensure one DPM member in Dubai

For Dubai RIT students:

- Request convenient and reliable bus schedule from Etisalat (regular intervals throughout the day)
- Request bus schedule from Etisalat to RIT for weekend (Friday and Saturday)
- Obtain cell phones for students, hand out on arrival (part of study abroad fee)
- Provide programs equivalent to those at RIT Rochester (i.e.: LabVIEW, Solidworks, MATLAB)
- Provide separate wireless at Etisalat for RIT Dubai Students (diff username and password)
- Provide RIT Dubai Informational Package upon arrival
  - Malls and Locations (with corresponding grocery store)
  - Contact information
    - RIT faculty/Emergency
    - Etisalat office & contact person
    - Taxi
  - Schedules (i.e.: class, school bus, public bus, metro, recreational facilities)
  - Facts about Dubai with Arabic language package
  - Etisalat Academy Facts

Issue	Solution
Personal Initial Issues	
Confusion about MSD, expectations, class instruction, and location	Pre-departure meeting with all group members, guide, and Dr. Hensel
Difficulty finding rooms for weekly meetings between Rochester and Dubai	Rochester – Reserve the Alumni Room Dubai – Get an appropriate room and reserve for the quarter
Skype is not available to download in UAE	Download Skype while in US
Uncertainty sharing documents	Use Google docs for working documents, Tortoise SVN for other files, and upload finished format documents to EDGE weekly.
Trouble scheduling meetings	All team members get Google email and use/share Google calendars
RIT Faculty/Staff Initial Issues	
Dubai members get automatically placed in separate course on MyCourses and unable to see content	Manual override of MyCourses by admin
Access to videos of lectures	Get all members access to Adobe Pro to share videos (contact Jessica Hooper at RIT Library)
Dubai staff unaware a MSD course was taking place	Get a faculty guide for Dubai
Internet is unreliable at Etisalat	Set up separate wireless network for RIT
RIT Dubai doesn't have video conference room	Add video conference room in Dubai
No purchasing procedure in Dubai	Create purchasing procedure for future teams. Include easier method of taxi reimbursement
Problems getting to campus	Ensure Etisalat offers adequate bus schedule for students to get to campus when needed
Lack of support for Dubai team members	Make sure at least one Dubai member has taken DPM and get a faculty guide for Dubai as well

Trouble scheduling meetings	Schedule appropriate classes earlier (before 5pm) in Dubai and later in Rochester (not before 11am)
Dubai computers do not have all the necessary programs	Install Matlab, LabVIEW, SolidWorks, etc. on campus computers
Dubai students not given proper orientation	Provide proper orientation and information needed to begin living in Dubai
Problems communicating with team members in Dubai	Provide cell phones to all study abroad students as part of the orientation fee
Ongoing Issues	
Gap in communications when using single contact member for Dubai & Rochester	Copy all team members on emails related to MSD to ensure everyone is informed
Skype lags during meetings	Allow breaks in conversation and use thumbs up to show understanding.
Internet is unreliable at Etisalat	Hold Skype meetings on campus
People not getting documents before meetings	Send out and documents for meetings the day before
Problems getting to campus when bus is unavailable	Get prior approval and receipt for taxi reimbursement
Gaps in communication from not confirming understanding of emails and action items	Confirm understanding of all emails
Difficulty hearing people during Skype meetings	Use mobile mic that can be passed around
During presentations in Dubai the board is used to present information and laptop is used to visually see other group presenting	Use a room with two smart boards to show work presented by both groups simultaneously

Etisalat Academy:

Rules in Dorms

- Boys are NOT allowed on girls floor
- Girls ARE allowed on boys floor as long as they remain in the lounge area or hallway (bedrooms are off limits)
- Must show Etisalat card to get into gated community

Room Information:

- Card access to rooms and active lights
  - Any card will work to active lights, doesn't have to be room card
- Private bathrooms for each room
  - Toilets have a bidet
- Provisions:
  - Electronics: Minifridge, TV, phone, and electric boiler
    - Adapter can be provided by main desk
  - Linens: Bedding, pillows, and towels
  - Furniture: Closet, dresser, and desk that need to be shared, individual night stands
- Two sets of washer and dryer are located at the end of each hallway. They are free to use.

Cafeteria:

- Buffet style open three times daily (see cafeteria schedule)
- Cost: Breakfast is 15 dhs and Lunch/Dinner are 25 dhs

Gym/Recreational Center:

- Three weight rooms, one is set aside specifically for women only
- Outdoor: track around soccer field, beach volleyball, basketball and tennis courts, pool
  - Won't turn on lights unless 10+ people are on the field
- Indoor: Table tennis, squash court, gymnasium with badminton, Jacuzzi, sauna, and steam room
  - Can take exercise classes for a fee
- Facility open from 8:00am to 11:00pm
- Closed to students from 6:00pm – 9:00pm
- Men not allowed in pool/spa until 5:30pm and women not allowed in evenings after 8:30 during weekdays. Mix on Weds after 3:30 and weekends anytime

Transportation:

- Private Bus:
  - Arrives at front door and goes to school and malls
- RTA Bus:
  - Bus stop outside Etisalat Academy Gates
- Taxi:
  - Can call personally or go to main desk and ask them to call. Much cheaper than in US.
    - Call ahead usually involves a small "booking fee" and is higher on the weekends
- Metro:
  - "Green line" metro planned to be completed by Summer
  - "Red line" is a 16dhs taxi ride or 4dhs bus ride away

Fun Places to Visit:

- Global Village
- Ski Dubai
- Dubai Creek Golf Club
- Burj Khalifa
- Atlantis
- Meydan Horse Race/Track (free)
- Chill Out Café (Café made of ice)
- Beaches
    - JBR
    - Jumeirah Beach Park
    - Jumeirah Public Beach (no fee)
    - Snoopy Island (near Sandy beach resort-Fujairah)
- Souks
    - Madinat Jumeirah Souks
    - Spice, Textile and Gold Souks around Dubai Creek
- Waterparks
    - Aquaventure
    - Wild Wadi
- Cities
    - Al Ain (zoo, camel market, oasis)
    - Hatta (climbing and hiking)
    - Abu Dhabi
    - Fujairah (hiking, snorkeling)
    - Dibba (climbing and hiking)
    - Ras Al-Khaimah (climbing)

Appendix A – Additional Information

Mall Information:

Mirdif City Centre

Link: http://www.mirdifcitycentre.com/mcc/Default.aspx

Supermarket: Carrefour

Festival City

Link: http://www.festivalcentre.com/storedir.aspx

Supermarket: Hyperpanda

Arabian Center

Link: http://www.arabiancenter.ae/media_center_lals.htm

Supermarket: Worldmart Hypermarket

Uptown Mirdiff

Link: http://www.uptownmirdiff.ae/main/index.aspx

Supermarket: Spinneys

Deira City Centre

Link: http://www.deiracitycentre.com/dcc/

Supermarket: Carrefour

Dubai Mall

Link: http://www.thedubaimall.com/en

Supermarket: Waitrose, Organic Foods & Cafe

Emirates Mall

Link: http://www.malloftheemirates.com/moe/Default.aspx

Supermarket: Carrefour, Lulus (next to mall but not attached)

Ibm Buttuta Mall

Link: http://www.ibnbattutamall.com/

Supermarket: Giants

Sample Schedules as of Winter Quarter:

Sample School Bus Schedule:

From Etisalat Academy	From RIT Campus
7:30	12:30
8:30	15:45
10:00	16:40
11:45	17:15
15:45	20:15
17:00	

Cafeteria Schedule:

Meal	Time
Breakfast	6:00-10:00
Lunch	12:30 – 4:00
Dinner	7:00 – 11:00

Bus Schedule from Etisalat to Malls:

Day of Week	Mall
Sunday	Dubai Mall
Monday	Dubai Festival City
Tuesday	Deira City Centre
Wednesday	Dubai Mall
Thursday	Dubai Festival City
Friday	None
Saturday	Deira City Centre

Useful Contact Information:

General:
Tel: +971 04 371 2000
Email: dubai@rit.edu
Website: www.rit.edu/dubai

Emergencies

Police (non-emergency)	04 229 2222
Police (emergency)	999
Fire	997

RIT Dubai Staff

VP - Student Affairs – Dr. Tom Raco	04 371 2002
Student Services - Michelle Vaz	04 371 2031
RIT Dubai Main	04 371 2000

Travel

Dubai Taxi	04 208 0808
Dubai Int'l Airport	04 224 5555
Hertz	04 282 4422
Thrifty (Car Rental)	04 337 0743

Couriers

Aramex	60 0544 000
DHL	800 4004
FedEx	800 4050

Hospitals

Al Wasl Hospital	04 324 1111
American Hospital Dubai	04 336 7777
Iranian Hospital	04 344 0250
Welcare Hospital	04 282 7788

Directory Enquiries

International telephone enquiries	151
Directory enquiries	181

Reality of Dubai:

UAE Lifestyle

- Dubai is 9 hours ahead of New York (ex: when it is 7:00 am in NY it is 4:00 pm in Dubai)
- Currency for Dubai dirhams and 3.75 dhs = 1 US dollar (so divide everything here by 3 or 4)
    - Don't pay taxes in Dubai
- Weekdays are Sunday – Thursday and Weekends are Friday and Saturday
- Dubai is one of the cleanest and safest cities in the world
- Use the metric system (weights are in kg, temperature in Celsius and speed limit in km/hr.)
- Outlets are mainly type G (used in UK) and some ungrounded type C (used in Europe)
- People are used to lower class workers picking up their mess
- No refunds for recycling cans
- No separation of church and state
- All toilets here have a bidet

Food

- Common foods are Arabic, Indian, and American
- All water is bottled and not recommended to drink tap water
- Not expected to tip servers

Transportation

- Prime forms are taxi, metro and buses for students (walking is very limited)
    - Do not have to tip taxi drivers
    - Small call ahead fee (this happens if you call ahead from Etisalat)
    - Larger beginning fees for taxis on weekends (6 dhs) and from airport (25dhs)
    - Allow about half hour to an hour wait for taxis on the weekends
- Majority of vehicles are high end brand names only a few years old
- Good maps and most online map programs are very inaccurate for Dubai
- Locations do not have address here, instead cross streets and landmarks are used

Entertainment

- Public display of affection and intoxication are strictly prohibited
    - Although, bars do serve alcohol
- Hulu, Megavideo and Pandora are all blacked unless using RIT VPN
- Unable to stream anything online (i.e.: CBS, NBC, MTV etc.) unless using RIT VPN

Suggestions:

- Purchase Dubai Entertainment Book to receive coupons/discounts on goods and services
- Sign up for an HSBC checking account so withdrawals from the ATM are free
    - It is free and there is no minimum balance required
- Bring/buy silverware and dinner ware, along with some containers to pack food for campus
- Bring reusable water bottle
- Most importantly, do your research and read some culture shock books:

Former RIT Dubai Student	Blog Website
Maddie Burke	madiganburke.blogspot.com
Steve Rugg	steverugg.wordpress.com
Kristin Roberts	krobertsindubai.wordpress.com
Dylan Connole	climbtheglobe.wordpress.com
Allison Schneider	allieschneider.wordpress.com
Andy Thistle	athistle.wordpress.com