A construction firm is renovating rustic cabins in Northern Michigan for weekend getaways. The firm has decided to “go solar” and has hired the engineering firm of Bénard and Somerton (aka BS Engineering) to provide preliminary designs for solar electric and solar hot water heating for the cabins. Two associates of the firm have been assigned to perform the design studies. One may wish to do the solar electric design and one may wish to do the solar hot water heating design. The construction firm would like to offer a variety of different cabin scales to its customers, ranging from very rustic to very upscale.

To perform the required analyses, the associates will use software developed by the RETScreen International Clean Energy Decision Support Centre (http://www.retscreen.net/). The software consists of two executable files, one for each application, that when run will produce Excel spreadsheets for the calculations. The executable files and some short directions are provided on the ME 417 web site.

**Solar Electrical Design:** Photovoltaics are to be used to provide the electricity for the cabins. As a modeling convenience the electric load will be modeled by 100 watt, AC light bulbs. To address the construction firm’s desire to have cabins of different scales, the design team should complete the design over the range of 2 to 15 light bulbs operating 4 hours a day. The design team is to consider two PV modules:

- a-Si at a cost of $4500 per kW
- poly-Si at a cost to be determined by the team

For the poly-Si PV module, the team is to determine the unit cost that will make such a system equivalent in cost to the a-Si system with a load of 10 light bulbs. Three figures should be developed in conducting this analysis:

- Figure 1: Graph of total capital cost versus electric load for the a-Si system
- Figure 2: Graph of cost of energy versus PV unit cost for the poly-Si system
- Figure 3: Graph of energy cost versus electric load for both systems

**Solar Hot Water Heating Design:** A flat plate solar collector is to be used to provide the hot water for the cabins that will be used for both space heating and domestic hot water. As a modeling convenience the heating load will be modeled by a hot water flow rate of liters/day at 80°C. To address the construction firm’s desire to have cabins of different scales, the design team should complete the design over the range of 600 to 3000 liters/day. The design team is to consider two flat plate collector systems:
Unglazed at a cost of $50 per square meter
Evacuated at a cost to be determined by the team

For the evacuated collector system, the team is to determine the unit cost that will make such a system equivalent in cost to the unglazed system with a load of 2000 liters/day. Three figures should be developed in conducting this analysis:

Figure 4: Graph of total capital cost versus water load for the unglazed system
Figure 5: Graph of cost of energy versus unit collector cost for the evacuated system
Figure 6: Graph of energy cost versus water load for both systems

For the cost analyses, an interest rate of 9% and a lifetime of 25 years are to be used.

The team is required to submit a technical memo that documents their work. It is suggested that this documentation might include the figures suggested above.
# ME 417
## Design of Alternative Energy Systems

### Project Grade Evaluation
#### Project 4 Design of a Solar Power System

Student Names: _____________________

<table>
<thead>
<tr>
<th>Topic</th>
<th>Assigned Score</th>
<th>Maximum Score</th>
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<td>Design for a-Si PV module system</td>
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<tr>
<td>Design for poly-Si PV module system</td>
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<td>Design for unglazed collector system</td>
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<td>Design for evacuated collector system</td>
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**Total** 100