Swimming in the Sun

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An explanation of why WPI should invest in a solar heating system for the pool in the new WPI Athletic Center

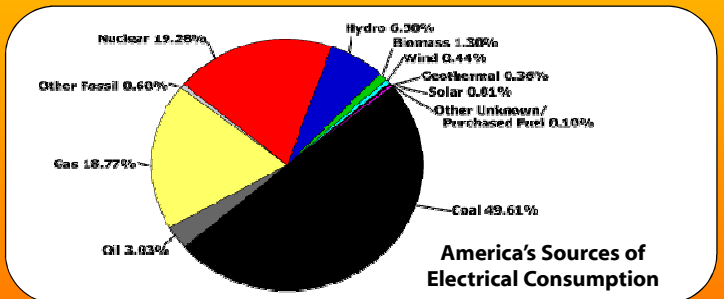
Abstract

Solar power is the renewable energy of the future. This study determines the economic feasibility of WPI utilizing solar energy. Solar heating the pool has a short payback period and would be both a realistic and beneficial technology for the future recreation center at WPI.

Image provided by: www.powermat.com

How Solar Heating Works

- Open loop system – pool water is circulated through thin black membranes
- Membranes on roof angled southward
- Water is pumped from the bottom to the top manifold
- Temperature of the water increases
- Water is cycled through the system and returned to pool
- The circulation is continuous during hours of sun light
- Sensors stop circulation once the pool reaches the desired temperature



America's Sources of Electrical Consumption

Image provided by www.epa.gov

Why Go solar?

- America is Dependent on Foreign Oil
- Coal Provides ~ 50% of America's Electricity
- Coal Produces Over 30% CO_2 Emissions
- There are Only a Finite Amount of Energy Resource: Oil, Coal, Uranium
- Solar Energy is the Most Viable Renewable Energy Source for WPI
- Required for WPI to Go Green: Solar Heating is an Excellent Economic Choice
- After Manufacturing There is no Pollution and Little Maintenance

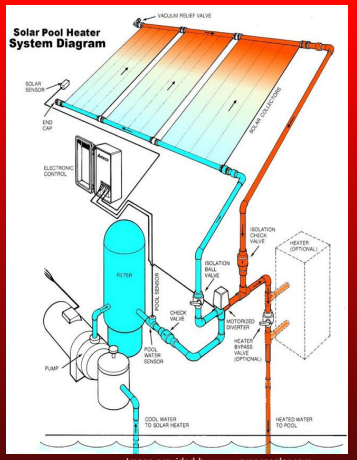


Image provided by: www.amecosolar.com

Payback Period Calculations

$$235\ \text{W insolation} \times \frac{1\ \text{KW}}{1000\text{W}} = 0.235\ \text{KW}$$

$$0.235\ \frac{\text{KW}}{\text{m}^2} \times 2.5\ \text{hrs of sun per day} = 0.5875\ \frac{\text{KWh}}{\text{m}^2\text{day}}$$

$$0.5875\ \frac{\text{KWh}}{\text{m}^2\text{day}} \times \frac{365\ \text{days}}{1\ \text{year}} = 214\ \frac{\text{KWh}}{\text{m}^2\text{year}}$$

$$214\ \frac{\text{KWh}}{\text{m}^2\text{year}} \times \frac{1\text{m}^2}{10.7639\ \text{ft}^2} \times 2600\ \text{ft}^2 = 51360\ \frac{\text{KWh}}{\text{year}}$$

$$51360\ \frac{\text{KWh}}{\text{year}} \times (0.7)(\text{efficiency}) = 35952\ \frac{\text{KWh}}{\text{year}}$$

$$35952\ \frac{\text{KWh}}{\text{year}} \times \frac{\$0.15}{\text{KWh}} = \$5393.00$$

$$\frac{\$25000\ \text{initial cost}}{\$5393.00\ \text{per year}} \approx 4.6\ \text{years}$$

Pool Cover

One way to make an indoor pool more efficient is to simply cover it when it is not being used. Evaporation is the biggest way a pool loses heat. A proper pool cover can reduce heat loss by 50-70%. Adding a cover to an pool can add efficiency to the pool system and therefore further benefit WPI economically and environmentally.

Image provided by: www.fillionassociates.com

Results

- The cost of the solar panels will be approximately $25,000 which is about 0.063% of the total cost of the whole athletic complex.
- 2,600 ft^2 out of about 33,000 ft^2 on the roof will be needed for the solar panels (approximately 8%)
- The panels will generate approximately 51,360 KWh
- The payback period for the panels will be about 4.6 years.

Conclusion

It is economically beneficial to utilize solar power to heat the pool in WPI's new athletic facility. The initial investment pays for itself in 4.6 years without grants. WPI should invest in solar power to heat the pool to save both energy and money, and to reduce the carbon footprint of WPI, therefore making WPI a greener community.