Physics and Mathematics of Sustainable Energy
Homework Three

College of the Atlantic

Due April 18, 2014

1. Most of the commercial tube lighting used throughout COA is 32 Watts, T8 linear fluorescents. This term the college plans to replace all 36 tube lights in the TAB kitchen with more efficient LEDs that only draw 25 Watts per tube. Assume that the kitchen lights are left on for 14 hours each day, 5 days a week, for 42 weeks of the year.

    (a) How much energy, in kWh, do the old fluorescent lights in the kitchen use annually?

    (b) How much energy, in kWh, will the new LED lights in the kitchen use annually?

    (c) The TAB kitchen is connected to a C meter. Using the C meter electricity and peak power demand charges, estimate the annual savings that the college will see from this investment. (See `http://goo.gl/GbzbTw`.)

    (d) If the same project were to be done on a B meter account, what would the annual savings be? (See `http://goo.gl/1i8hBD`.)

    (e) And what about on an A meter account? (See `http://goo.gl/UiCHYj`.)

2. The Bowen coal-fired power plant is the largest coal-fired plant in North America. Its generating capacity is almost 3.5 GW.

    (a) Approximately what area of solar panels would be needed to generate this much electrical power? Come up with a useful way to visualize or conceptualize this area.

    (b) 3.5 GW would be enough electricity to power approximately how many homes in the US? Come up with a useful way to think about this number.

3. Estimate the energy required to heat the water for a typical shower. Express your answer in Joules and kWh. If this water was heated with an electric heater, about how much CO_2e would be emitted as a result, assuming that you take one shower a day? Is this amount of CO_2e a little or a lot? Explain.