The environmental impact of washing a load of dirty dishes in an electric dishwasher differs from that of washing them by hand in a sink. Use the information and data below to answer the questions that follow. Show your calculations.

Assume the following:

1. The dishes all fit in one load.
2. The water coming into the water heater for the sink and into the water heater in the dishwasher is at 50 ^{o}F.
3. The water heaters for the sink and the dishwater are both 100 percent efficient.
4. In one complete cycle, the electric dishwasher uses 10 gallons of water heated to 140 ^{o}F and the dishwasher also uses 0.500 kilowatt-hour of electrical energy for its mechanical operation.
5. Washing the dishes by hand requires 20 gallons of water heated to 110 ^{o}F.

Other information:

1 gallon of water = 8 pounds of water

1 BTU = the amount of energy needed to raise the temperature of 1 pound of water by 1 ^{o}F

1 kilowatt-hour = 3,400 BTUs

(a) Calculate the total energy (in BTUs) used to both heat the water and run the electric dishwasher to wash a load of dishes.

(b) Calculate the energy (in BTUs) used to heat the water for washing the load of dishes by hand.

(c) Discuss the economic and environmental costs and benefits of

i. using the electric dishwasher (including its manufacture and disposal)

ii. washing the dishes by hand.