Answers 1. a. 2,000 kcal; b. 8.37 x 106 J = 8.37 MJ; c. 7,940 Btu; d. 11.9 minutes.   
  
2. b. The second law of thermodynamics prevents 100 percent conversion of heat to mechanical or electrical energy. A typical coal-fired power plant operates at about 33 percent efficiency, meaning that only one-third of the energy in the coal is converted to electricity.   
  
3. a. 1,941 ccf; b. $1,748; c. 9.2 years   
  
4. a. 9.57 MBtu; b. 8 percent; c. 1,200   
  
5. a. 2,190 kWh; b. 21.9 percent; c. 45.7 m2   
  
6. 498 tons   
  
7. a. 4,000; b. Answers vary   
  
8. Battery energy: 4.5 Wh = 4.5 x 103 kWh.  
Cost per kWh: $1.00 / 4.5 x 103 kWh = $222/kWh.  
Comparison: Electrical energy from the battery costs $222 / $0.10 = 2,220 times as much as that delivered by the power company.