Engi 9614: Renewable Energy and Resource Conservation, Assignment #1, Oct. 4th 2013, "Overview of energy storage systems for storing electricity from renewable energy sources in Saudi Arabia"

1. 150×10^9 watts in 150 GW

2. Humidity and temperature

3. $- 10°C$ to $55°C$ (or according to Table 1 – 9.4°C to 51°C)

4. The need for air conditioning

5. Wadis are low lying areas or channels that fill with water in the rainy season but are dry the rest of the year

6. Battery efficiency, cycle life, capital cost, operating and maintenance costs, disposal costs, refurbishment costs, environmental costs

7. It is how much of the battery resource has been used up

8. Uninterruptable power supply

9. 0.62

10. It is the average load in a year divided by the peak or maximum load in a year

11. Average annual load as a daily load is: $$\frac{52,794 \times 10^9 \, \frac{J}{s} \cdot h}{365 \times 24 \, h} = 6026.7 \times 10^6 \, \frac{J}{s}$$

The load factor is:

$$\frac{6026.7 \times 10^6 \, \frac{J}{s}}{9725 \times 10^6 \, \frac{J}{S}} = 0.620$$

12. Pumped storage and compressed air energy systems would be potential systems because in Figure 2 it is shown that they are large enough for a 1 GW plant and they can function independently for a number of hours which is a requirement of "energy management".

13. "Bridging power" is the other term that is used in place of UPS

14. We need better storage systems to make better use of renewable energy options and we need to use renewable energy to decarbonize and address climate change