Hw2 #1,2

Hw2 Solutions

Problem 1

1) Add up each kW x h on the plot
   = 16 kWh

2) Peak on plot is 3kW

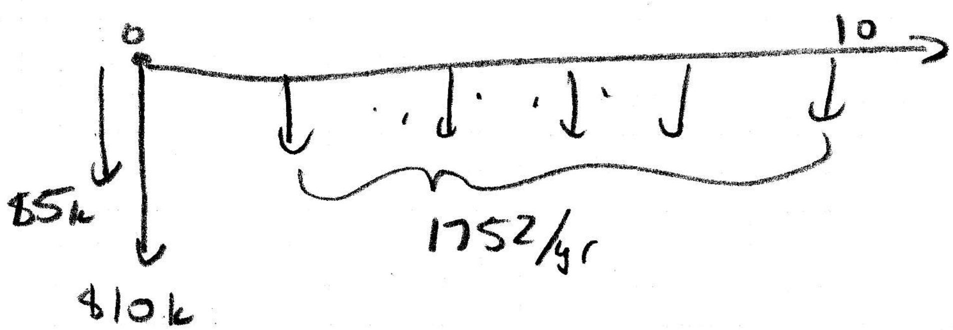
3) average power = $\frac{16\,kWh}{24h} = \frac{2}{3}\,kW$

Problem 2

1) First calculate annual cost of energy

$$\frac{16\,kWh}{day} \cdot \frac{365\,day}{yr} = 5840\,kWh/yr$$

$$\frac{5840\,kWh}{yr} \cdot \frac{\$0.3}{kWh} = \$1752/yr$$



2) $10k + 5k + \frac{1752}{0.149} = \$26800$

from P→A table

Awz #3

Problem 3

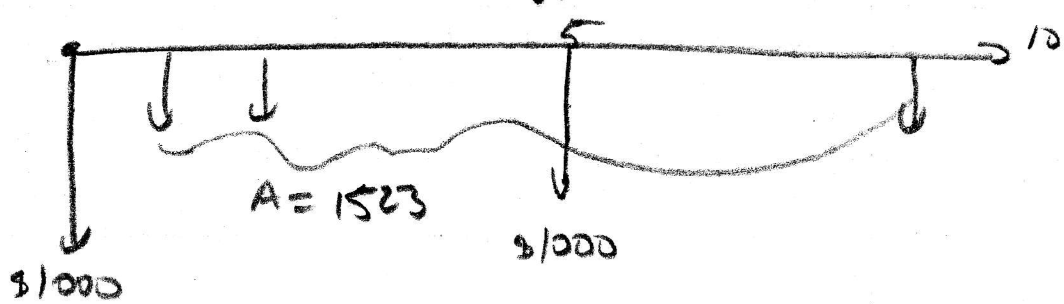
1) First calculate how much gas per year.

$$5840\ \frac{kWh}{yr} \cdot \frac{1\,kg\,(gas)}{46{,}000\,kJ\,(gas)} \cdot \frac{100\,J\,(gas)}{30\,J\,(elec)} \cdot \frac{\ell}{0.75\,kg} \cdot \frac{\$.75}{\ell} \cdot \frac{3600\,J}{Wh}$$

efficiency

energy density from notes

$$= \frac{\$1523}{yr}$$



2) $PV = 1000 + 1000(0.68) + \dfrac{1523}{0.149}$

$= \$11900$

3) The generator is 44% the cost of the grid system, so it is a better investment

Hw2 #4

Problem 4

1) First: how many panels do I need?

my PV plot shows that if I have a 1kw system (1kw peak) then I will get 7kwh/day.

I need 16 kwh/day so I need at least

$$\frac{16}{7} = 2.3\text{kw peak to get } 16\frac{\text{kwh}}{\text{day}}$$

round that up to 3 kw.

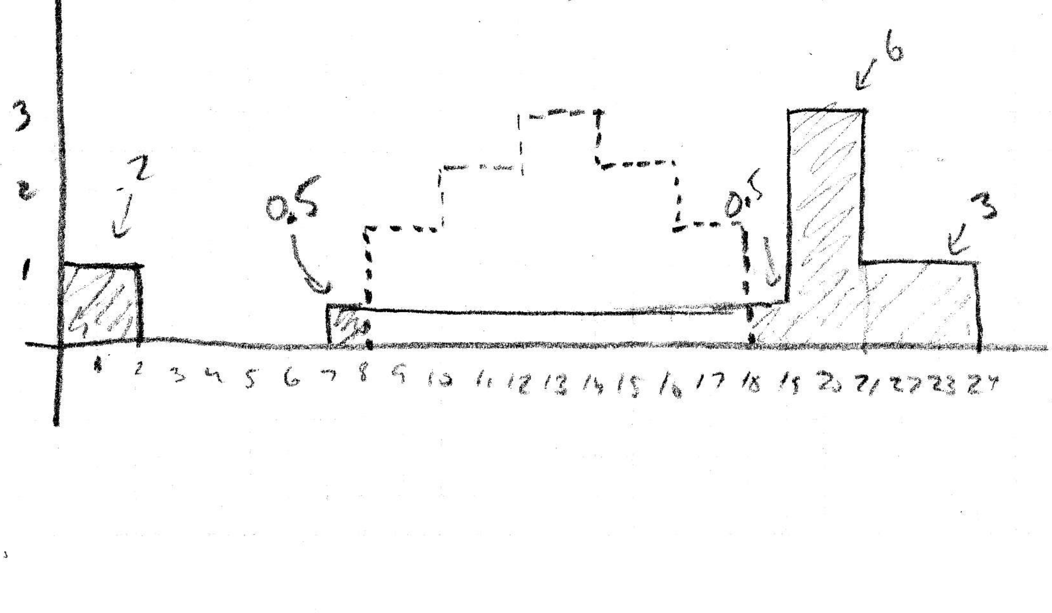
the cost of the panels is:

$$3\text{kw} \times \frac{\$.91}{\text{w}} \cdot \frac{1000\text{w}}{\text{kw}} = \$2730$$

Now how many batteries do I need?

sum up the area of the load that is not covered by the PV directly. (shaded area)

= 12 kWh



HW2 #4

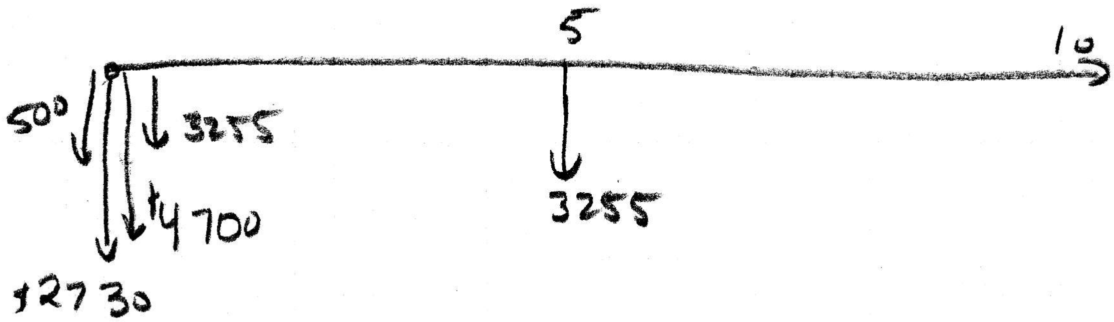
so need to store at least 12 kwh

each battery is $12V \cdot 178Ah = 2.136$ kwh

so need $12 \text{ kwh} \cdot \frac{1 \text{ bat}}{2.136 \text{ kwh}} = 5.7$ bat

so you need at least 6 or 7 so lets use 7.

$7 \times \$465 = \$3255$



$PV = 500 + 3255 + 4700 + 2730 + 3255 \cdot 0.68$

$= \$13,400$

3) It is a little more than the generator but better since no gas & noise to deal with

HW2 #5

HW2 Prob 5 (extra credit)

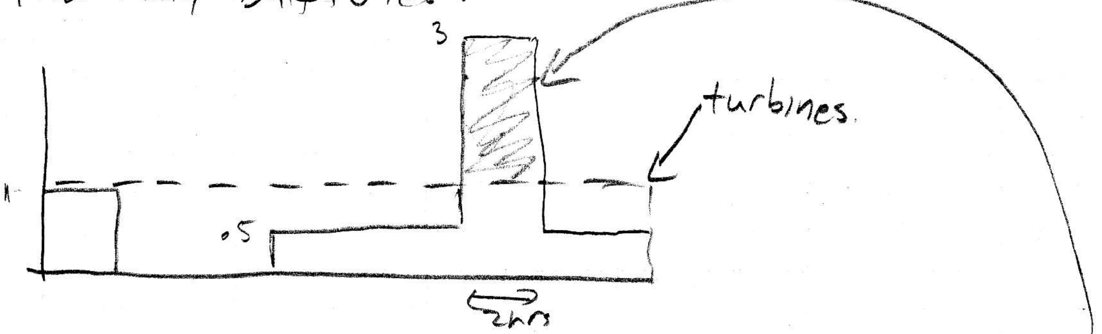
We need $16 \frac{kWh}{day}$

The turbine produces $\frac{1500W}{3} = 500W$ constant

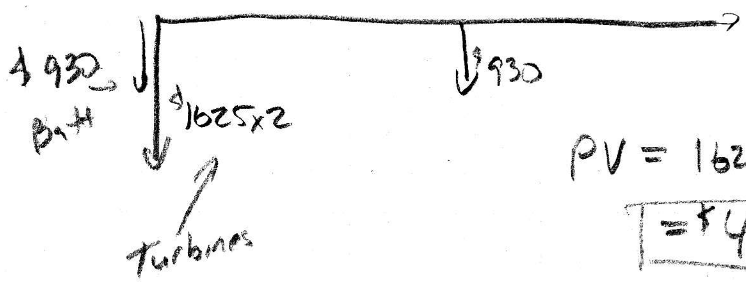
so $500W \times 24hrs = 12kWh$

which is not enough so I need 2 turbines. giving 1kW constant output

How many batteries?



So at least I need to store the shaded area which is 4 kWh. Each battery was 2.1 kWh so I need at least 2 which cost $\$465 \times 2 = \$930$



$PV = 1625 \times 2 + 930 + 930(.68)$

$\boxed{= \$4812}$

3) This is much cheaper than the other options so I will retire on wind power!