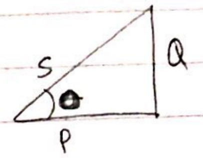
#2 The most surprising thing to Tesla, Westinghouse, & Edison would be the modern grid's ability to transport electricity to places that are thousands of miles away. Transmission lines operated at a much smaller voltage back in Edison's, Tesla's, & Westinghouse's times, in comparison to today's. Lastly, they will be surprised by the efficiency of today's powerlines since the losses have been minimized in comparison to the past.



#3 a) $I_L = \dfrac{.6 \times 10^6}{(4\times10^3)(.9)} = 166.67$ Amps

$\cos(\theta) = \dfrac{P}{S}$

$S\cos(\theta) = P$

b) $I_L = \dfrac{.6\times10^6}{(12\times10^3)(.9)} = 55.55$ Amps

c) Raven: 1/0 ; Resistance = $\dfrac{\Omega}{1000ft}$; AC@75°C = .217

$$R = \frac{.217\,\Omega}{1000ft}\left(\frac{3.28084\,ft}{1\,m}\right)\left(\frac{1000\,m}{1\,Km}\right)\left(\frac{10\,Km}{1}\right) = 7.119\,\Omega = 7.12\,\Omega$$

d) Quail: 2/0 ; AC @ 75°C = .176

$$R = \frac{.176\,\Omega}{1000\,ft}\left(\frac{3.28084\,ft}{1\,m}\right)\left(\frac{1000\,m}{1\,Km}\right)\left(\frac{10\,Km}{1}\right) = 5.774\,\Omega = 5.77\,\Omega$$

e) $I_L = \dfrac{S}{V(\cos\theta)} = \dfrac{.6\times10^6\ VA}{(4\times10^3)(.9)} = 166.67\ A$

$\dfrac{P_R}{P_L}\times100\% = \dfrac{197.78\times10^3\,W}{.6\times10^6\,W}\times100\% = 32.9\%$

$P_R = (166.67\,A)^2(7.12\,\Omega) = 197.78\ KW$

f) $I_L = 166.67A$

$P_R = (166.67A)^2(5.77\,\Omega) = 160.28\ KW$

$\dfrac{P_R}{P_L}\times100\% = \dfrac{160.28\times10^3\,W}{.6\times10^6\,VA}\times100\% = 26.7\%$

g) I_L @ 12KV = 55.55 A

$P_R = (55.55\,A)^2(7.12\,\Omega) = 21.97\ KW$

$\dfrac{P_R}{P_L}\times100\% = \dfrac{21.97\times10^3\,W}{.6\times10^6\,VA}\times100\% = 3.66\%$

h) I have learned that operating power lines at a higher voltage results in the most efficient transport & delivery of electricity. Parts g, when compared to e & f, shows that losses are minimized significantly when voltage is increased

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#4 a) $P = (12V)(100\ Ah) = 1200\ Wh$

$E = 1200\ Wh = 1.2\ KWh$

$E = 1200\ Wh \left(\frac{60\ min}{1\ h}\right)\left(\frac{60\ sec}{1\ min}\right) = 4.32 \times 10^6\ J$

b) $\frac{E}{20 min} = \frac{4.32 \times 10^6\ J}{20\ min}\left(\frac{1\ min}{60\ sec}\right) = 3.6 \times 10^3\ J/s$

$P = 3.6\ KW$

c) $P = VI$

$I = \frac{P}{V} = \frac{3.6 \times 10^3\ W}{120\ V} = 30\ Amps.$

d) Model S: I grabbed these from Tesla's website.

75D → 75 kWh Battery

100D → 100 kWh Battery

P100D → 100 KWh Battery

#5 a) Laptop: 200 W (Average Quantity)

b) Typical Refrigerator: 500 W (Average Quantity)

c) PHEV: 34KWh (Average Quantity)

d) Single family Home: $897\ kWh/month = \left(\frac{1\ mo.}{\sim 30\ days}\right)\left(\frac{1\ day}{24\ hrs}\right) = 1245.833\ W$ (Average Quantity)

↳ eia.gov/tools/faqs/faq.php?id=97&t=3

e) Cory Hall: $85,435\ kWh/past\ week = \left(\frac{1\ wk}{7\ days}\right)\left(\frac{1\ day}{24\ hrs}\right) = 508541.7\ W$ (Average over last week)

↳ us.pulseenergy.com/UniCalBerkeley/dashboard/#/location/1656

f) Berkeley Campus (2009): 218,800,000 KWh (Average)

↳ sustainability.berkeley.edu/sites/default/files/CalCAP_energy-efficiency_report_052010.pdf

g) City of Berkeley: 16,000 MWh (2013 - Average Quantity)

↳ cityofberkeley.info/uploadedFiles/Planning-and-Development/Level_3_-_Energy_and_Sustainable_Development/Muni%20energy%20CAP(1).pdf

h) State of california: 259.5 TWh (Average Quantity - 2014)

↳ energy.gov/sites/prod/files/2015/05/f22/CA-Energy%20Sector%20Risk%20Profile.pdf

i) USA: 12,986.74 KWh (Average - 2014)

j) World: ~23,000 TWh (Average - 2017)

↳ yearbook.enerdata.net/electricity/electricity-domestic-consumption-data.html

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