BurkeyAcademy: Production Theory Problems

Duke Energy is an electricity producer where Megawatts of Power (Q) = $10F^{1/3}K^{2/3}$, where Q is output, F is Fuel (instead of Labor), and K is capital. MP_F (MP_L)= $(10/3)F^{-2/3}K^{2/3}$ and $MP_K = (20/3)F^{1/3}K^{-1/3}$.

Let w (cost of fuel) = \$4 per gallon and r = \$16, the rental rate of capital.

a. First, consider the short run. Suppose that Duke Energy had 100 units of Kapital. What is Duke's Fuel Requirements Function? (Fuel=f(Q)). Find how much fuel they need to produce 500 units of output.

b. Now calculate how much fuel they need to produce 1000 units of output. Do they have increasing, decreasing, or constant returns to Fuel?

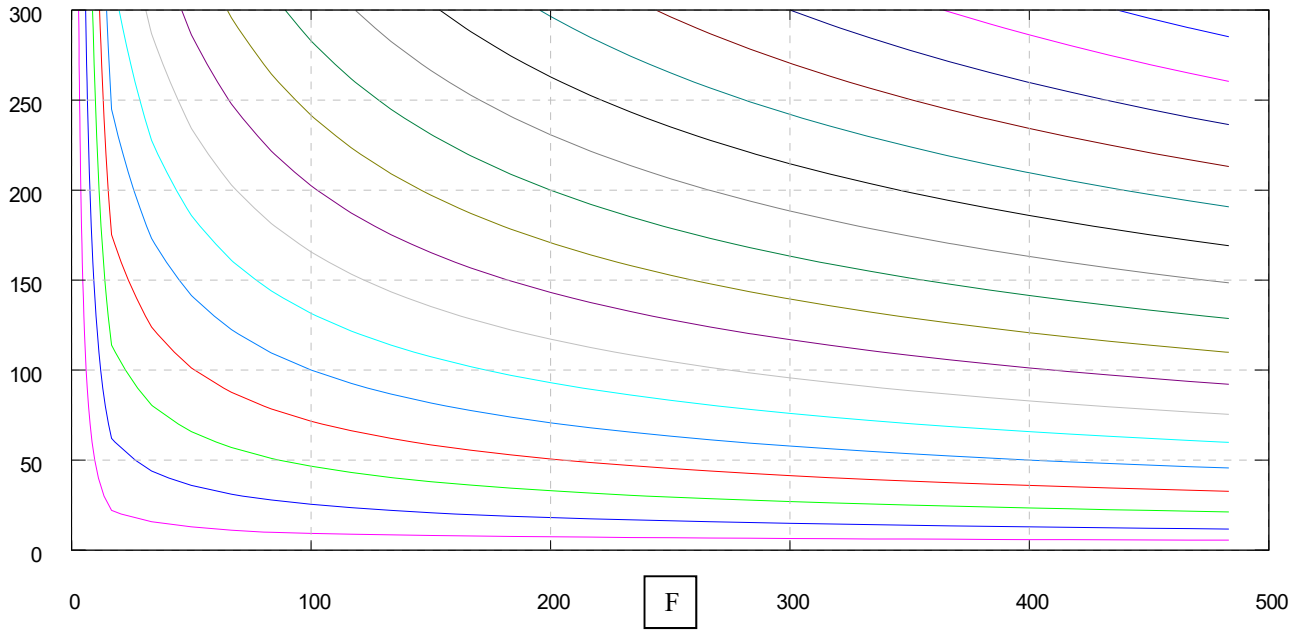
c. Still in the short run, what is Duke's Short run total cost function? (TC=f(Q)). Label which part is fixed cost, and which part is variable cost. Calculate their total cost for producing 1000 units of output, and 1001 units of output.

d. What is Duke's Short Run Average cost function? Calculate the average cost of producing 750 units of output.

e. What is their short run marginal cost function? Find the marginal cost of the 1001^{st} unit of output.

f) Still in the short run, suppose that Duke can sell electricity for \$5 per megawatt. Will it make a profit if it sells 100 megawatts? 1000 megawatts? 5000 megawatts?

g: Now, in the long run, Find the optimal level of Fuel and Kapital it would need to produce 100 megawatts, 1000 megawatts and 5000 megawatts. FYI, the graph below contains IsoQuants up to around Q=2,800.



h. Given your answers to g, calculate the total cost and average total cost for producing 100, 1000, and 5000 megawatts.

i. Use h) to compare with f). What is different and why?

j. Suppose Duke Energy had a budget of only $2000. If they could choose the optimal level of kapital and labor, how much could they produce, using how much K and F?