ENVIRON/ENERGY 590.05 - Economics of Modern Power Systems
Fall 2022

Instructor	**TA**
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Assignment #4
Due date: 11/11/2022

Suppose you work for a public utility commission (PUC) that is responsible for regulating 20 electric utilities. It is time to do the rate case review for these utilities. As discussed in class, the first step is to compute the revenue requirement. For this assignment you will help calculate the efficient operational cost that these utilities are allowed to charge their customers.

Recall that under yardstick/incentive regulation you can do that using benchmarking techniques, more specifically the DEA model for utility benchmarking analysis we discussed in class. The data for the case study with 20 utilities is available on data file *DEA_Data.xlsx* which can be found on Sakai under A4.

The DEA Model will consider as input the operational cost (OPEX) and as output the network extension, total consumption and number of customers. You may work with the multiplier model (primal) or the envelopment model (dual), whichever makes more sense to you.

(a) Fill out the table below. Start by implementing the DEA-CRS (constant returns to scale) efficiency analysis model using Excel, Python or R to identify the efficiency scores of the four utilities (U8, U10, U12 and U16). Then change your model, i.e., the script, to run VRS (variable returns to scale), NIRS (non-increasing returns to scale) and NDRS (non-decreasing returns to scale). Remember all you need to do is add more if statements when creating the LP and changing the bounds for u_0.

	U8	U10	U12	U16
CRS				
NIRS				
VRS				
NDRS				

(b) Comment on your results for part (a) based on the efficiency scores you obtained. For example, which model leads to the highest efficiency for all utilities? Why?

(c) Also from the results on part (a), which utilities are peers for U8? How do you know? What about U10, U12 and U16? Anything stands out when comparing the peers for each utility? Explain your response.

(d) Calculate the technical, scale and overall efficiencies.

	U8	U10	U12	U16
Technical Efficiency				
Scale Efficiency				
Global Efficiency				

(e) Can you rank these 20 utilities from most efficient to less efficient just with the results from part (a)? Why?

(f) Based on your response for part (e), rank these 20 utilities using DEA-CRS and DEA-VRS. By ranking I mean compute the efficiency score for all utilities and then order the score from highest to lowest. Create a table with the results for the two models. Then draw a graph on Excel comparing these results. *When you draw the graph make sure your rows represent the same utility since the CRS and VRS might lead to different rankings.* Look at the graph and verify if it confirms your response to part (b) as to which model will always lead to the highest efficiency.

(g) Under the DEA-CRS model, calculate the efficient operational cost (OC) as part of the required revenue (RR) for each one of the utilities.