While some data has been provided for you, feel free to find other data and make other assumptions to support your answers of both questions. [Helpful web site: http://www.eia.doe.gov]


As suggested in the article, the average amount spent on transmission line construction has declined $115 million per year for 25 years (in real terms). Also, FERC feels the major transmission constraints could be fixed nationally for $12 billion (a one-time expense).

a) Assume there are 2 options to paying for the $12 billion investment in new transmission lines to all customers in the US: (1) a tax on electricity (paid by usage) and a one-time cost per user. How much would each option affect the average price of electricity? Be sure to break out your answer amongst the categories given in the article (generation, transmission, etc).

b) How might a more focused approach to improving transmission constraints solve the problem? In that case estimate the average price of electricity. Be sure to break out your answer amongst the categories.

c) Instead of spending the $12 billion on increased transmission capacity, estimate the benefit of spending the same amount of money on private power plants in cities where no new transmission lines would be needed. Assume the price of constructing these new plants is $1500 per kW and the cost of producing the electricity is 5 cents per kWh. Be sure to consider your costs/benefits amongst the categories above.

d) Discuss which is the best option from an infrastructure management perspective.

**Question 2 (8 pts):** Consider a system with 4 condition states: 1 (excellent), 2 (good), 3 (fair), and 4 (poor). The system consists of 1000 transmission line segments. At t=0, 80% of the network is in state 1 and the remainder is in state 2.

Assume that each segment may either remain in its current state or deteriorate at most to the next lower state (as we discussed in class). Assume a Markovian deterioration process. The following vector P contains the relevant ‘same state’ transition probabilities: \([0.85, 0.82, 0.78, 1]\). Assume no repair or rehabilitation work is done.

a) After one year, what is the distribution of transmission line segments in each state?

b) After two years, what is the distribution of transmission line segments in each state?

c) After ten years, what is the distribution of transmission line segments in each state?

d) Develop a visual aid to show your results from parts a-c above.

e) Eventually, as segments get to the fair and poor states, repairs will be made. Assuming 20% of segments in state 3 and 40% of segments in state 4 are repaired back to excellent condition, how could the effect of these repairs and rehabilitations be built into your model? How does this change your answer to part (c)?

**Question 3 (20 pts):** The article by Beimborm and Puentes of the Brookings Institution available at http://www.brookings.edu/es/urban/publications/20031215_beimborn.htm questions the equity of transportation in the US from several perspectives. Compare our discussions in class and in homeworks (e.g. your estimates of allocating gas tax revenues) with the points presented in this paper. Limit your response to 3 pages. How would the framework of infrastructure management as we have discussed it in class need to change to accommodate their proposed changes?