Screwbean Wind Farm Study. Nov. 30, 2004. (same credit as lab experiments)

The Screwbean 138kV substation is located in west Texas, halfway between Midland/Odessa and El Paso, near Guadalupe Mountains National Park (see the ERCOT map). This is prime wind country, and another wind farm is already located in the area. Your job is to examine the feasibility of transporting 50MW of wind power from a new wind farm near Screwbean to a "green power" customer at a different location in ERCOT. In particular, you are to determine the impact of this transaction on the losses in individual ERCOT control areas, and also determine if any high or low voltages, or line overloads, are created by your transaction. To perform the analysis, you will use a 10,000 bus (i.e., node) version of PCFLO, **PC10000.exe**, together with a 2001 ERCOT summer peak loadflow case (in which most bus names have been disguised for security reasons). The loadflow case has 4860 busses, and 5851 branches. You will prepare a ½ to 1 page summary report of your study, as if you were submitting it to a client. Tables should be attached as an appendix and should not part of the ½ to 1 page discussion. Explain to your client how many MW of the generated 50MW can be delivered to the green power customer. Quantify the MW needed by each negatively-impacted control area to pay back for increased losses.

Here are the steps:

1. Come to Dr. Grady's office and request a green power customer bus. Each student will have a unique bus. Locate the Screwbean bus and your green power customer bus on the ERCOT map. Using the map, visually imagine the paths that the power might take as it flows from Screwbean to your green power customer bus.

2. Download **PC10000_411.zip**. Read the **README_PC10000_411.txt** file. Copy the input data *.csv files as instructed in **README_PC10000_411.txt**. Then, run **PC10000.exe** on the loadflow "base case" (i.e., the 2001 ERCOT summer peak case). When the DOS screen appears, press the "Enter" key four times (which automatically answers the questions asked by the program). You will see the progress of the program as it writes an execution log to the screen. Examine the output files produced, especially **exlog.txt, asoln.csv,** and **out5.csv**, using Excel to view the **csv** files. P and Q are in percent, which correspond to MW and MVAr. Voltages are in percent of nominal (and in your case, nominal is either 138kV or 69kV). Print out the **asoln.csv** file, using the landscape option. The numbers in your **asoln.csv** should match those in the zipped **asoln_B01.csv**.

3. Familiarize yourself (for a few minutes only) with the PCFLO user manual by viewing it **on the screen** (no printout).

4. Look in **bdat.csv** and find the SCRWBEAN 138 substation (bus 1095) and your green power customer bus. Look in your **out5.csv** file to see the P and Q flows in lines/transformers attached to these busses. Note in **out5.csv** the voltage magnitudes and phase angles at these two busses.

5. Rename the solved basecase output files as follows: **exlog_base.txt, asoln_base.csv,** and **out5_base.csv**.

6. Now, in **bdat.csv**, add 50MW, 25MVAr of generation to the SCRWBEAN 138 bus.

7. In **bdat.csv**, add 50MW, 25MVAr of load to your green power customer bus.

8. In **adat.csv**, add 50MW of export power to control area that contains SCRWBEAN 138.

9. In **adat.csv**, add 50MW of import power to the control area that contains your green power customer bus.

10. Re-run **PC10000.exe**. Save the input and output files with ***_gen50.csv**. Print out the **asoln_gen50.csv** file, using the "landscape" option.

11. View file **out5_gen50.csv** and check for any line overloads and high/low voltages created in the vicinities of SCRWBEAN 138 and your green power customer bus. (In an actual study, these would have to be described and remedies proposed. However, do not investigate remedies in your study.)

12. Tabulate area by area, by comparing files **asoln_base.csv** and **asoln_gen50.csv**, the increase/decrease in each control area's losses due to the 50MW transaction. The areas with increased losses will expect payment in-kind from the wind power company. This can be accomplished by lowering the delivered power to a value less than 50MW, and using some of the 50MW generation to pay back the control areas that are negatively impacted.

13. Use the pay backs from Step 12 to estimate how many MW can actually be delivered to your green power customer bus after the pay backs are made.

14. Write a brief report and turn it in no later than 5pm, Friday, December 3.

15. **(Optional)**. Reverse the transaction by putting the 50MW generator at your green power customer bus, and taking power out at Screwbean 138. Analyze the results and compare to your original transaction. Question, before starting - do you think that the pay backs will go up, or down? (Note – the answer depends on the prevailing flow directions of P and Q before the transaction is made, and whether your transaction increases or decreases the prevailing P and Q flows.)