HW# 6, Screwbean Wind Farm Study. October 26, 2004.

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 several wind farms are already located in the area. Your job is to examine the feasibility of transporting 50MW of power from a new wind farm near Screwbean to the U.T. Austin campus. 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 version of PCFLO (i.e., **PC10000.exe**), together with a 2001 ERCOT summer peak loadflow case (in which most bus names have been disguised). You should prepare a ½ to 1 page summary report of your study, as if you were going to submit it to your client. Tables should be attached as an appendix. Explain to your client how many MW must be generated at Screwbean to deliver 50MW to U.T. Austin. Quantify the MW needed by each negatively-impacted control area to pay back for their increased losses.

Here are the steps:

1. Download **PC10000.zip**. Read the **README_PC10000.txt** file. Familiarize yourself with PCFLO by quickly reading through the user manual (spend no more than 15 minutes doing this for now). Then, run **PC10000.exe** on the loadflow "base case" (i.e., the 2001 ERCOT summer peak case). Examine the output files produced, especially **exlog.txt, asoln.csv, vsoln.csv, isoln.csv** and **out5.csv**. Use Excel to view the **csv** files. Print out the **asoln.csv** file, using the landscape option. The numbers in your **asoln.csv** should match the zipped **asoln_B01.csv**.

2. Find the Screwbean 138kV substation (SCRWBEAN 138, bus 1095) and the U.T. Austin Harris 69kV substation (HARRIS 69, bus 9204) in the **out5.csv** file. Note their voltage magnitudes and phase angles, and the P and Q flows in lines/transformers attached to these busses.

3. Save the basecase input files as **bdat_base.csv, ldat_base.csv, adat_base.csv, and options_base.csv**. Save the solved basecase output files as **exlog_base.txt, asoln_base.csv, vsoln_base.csv, isoln_base.csv** and **out5_base.csv**.

4. Add new PV bus SB WIND as bus 2 in **bdat.csv**, using 20 for its control area. Put 50MW (i.e., 50% on 100MVA base) of generation on this new bus, with a Max Q Gen of 25MVAr, and a Min Q Gen of negative 12.5MVAr. For the desired voltage, put a value that is 0.5% higher than the base case voltage at SCRWBEAN 138.

5. Add new PQ bus UT CAMPUS as bus 3 in **bdat.csv**, using 21 for its control area. Put 50MW, 25MVAr of load on this new bus.

6. Attach new bus SB WIND to SCRWBEAN 138 through a line with impedance R = 0.1%, X = 1.0%, B = 0%.

7. Attach new bus UT CAMPUS to HARRIS 69 through a line with impedance R = 0.1%, X = 1.0%, B = 0%.

8. Add control area SB as area 20 to **adat.csv**, with a desired export of 50MW (i.e., 50%). The area control bus number will be that of SB WIND. Use an export solution tolerance of 0.1%.

9. Add control area UT as area 21 to **adat.csv**, with a desired import of 50MW (i.e., negative 50MW export). The area control bus number will be that of UT CAMPUS. Use an export solution tolerance of 0.1%.

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. Tabulate, area by area from **asoln_gen50.csv**, the increase/decrease in each control area's losses compared to the base case. The areas with increased losses will expect payment from the wind power company. This can be accomplished by putting in generator larger than 50MW, and exporting some power to the control areas that are negatively impacted.

11. Use the loss increases from Step 10 to estimate how much actual generation would be needed at SB WIND to deliver 50MW to UT CAMPUS **and** payback the extra losses to the negatively-impacted control areas.

12. Check for any line overloads and high/low voltages created in the vicinity of SCRWBEAN 138 and HARRIS 69. (In an actual study, there would have to be described and remedies proposed. However, do not investigate remedies in your study.)

13. Repeat Steps 10 - 12, but this time reverse the process and send 50MW from UT CAMPUS to SB WIND Save your files with ***_load50.csv**.

14. Describe the impacts of both transactions in your report.