**Glossary:**

NRG – Energy

CO2 – CO2 equivalent

**What the different spreadsheets are:**

Each “Results\_xxx.xlsm” represents one scenario. The “xxx” describes the scenario. “CO2\_100” means CO2 at $100/ton. Then, there is the word “\_all”. That says it was run on all 13 regions. There is one of these for each scenario – for each price of CO2.

The “Compare\_xxx.xlsm” compares the various scenarios.

**How to run Results/Compare:**

Download all the files, including HowTo.docx. You must have done that if you are reading this.

Right-click on each .xlsm file in the file manager, and set properties to allow macros.

Open “Compare\_xxx.xlsm”. Enable macros here. This should open all the Results…xlsm files. If that did not happen, click on the “To Line” or “To Bar” button. Once they have all loaded, click on each Results\_xxx.xlsm file, and enable macros in each one. Go back to Compare\_xxx.xlsm.

On sheet “Graph,” cell A1, is the region. If you click on it, an arrow appears to the right. Hit this arrow to choose a region or Entire\_US to look at entire US. EIA divides the country into 13 regions, like California and Mid West.

Cell A2 is what you are graphing - Cost, Energy (MWh), MTons CO2 etc.

Cell A3 selects which energy source you are graphing.

On sheet “Graph\_1y”, A1 and A2 are the same functions. B3 is the single year to be analysed – 27 is normally used (2050). X axis is the various scenarios, and all energies are shown separately.

The Results\_xxx.xlsm files have one scenario each. A1 and A2 are the same function.

**How the model works:**

At the base of the model, there is EIA data on the hourly use of each energy type in 13 regions of the US. The model uses the years 2020-2023 inclusive. This gives me a spreadsheet of 35,064 rows – one row per hour – and columns for Solar, Wind, Nuclear, etc. We call this year 0.

It also uses the EIA (when possible) for things like price, maximum build rate, lifetime, etc.

Initial demand is set at the sum of energies for each hour in year 0. Again, 35,064 values.

For each year

1. The model takes previous year, increases demand, and applies a decay rate (1/Lifetime) to each energy source.
2. An optimizer then finds the best mix of energy sources that meets demand.
3. Results are saved.

Then, Excel Macros are used to create the Results\_... and compare\_xxx.xlsm spreadsheets.

**How to set up to run your own scenarios:**

Running is very processor intensive. I had to get a bigger case and go to water-cooling to avoid the processor (Intel I7) getting to 100C. The 16 processors were all being used at once. Took about 40 minutes to run 5 scenarios (CO2\_Price), on all 13 regions for 27 years.

Set up python and github.

Make sure that your version of python.exe and git.exe are included in your path.

Download code from http://github.com/cliffgold/optimize

Open Macro/Overlord.xlsm

Design test.

Hit Run button.

Contact Cliff. This is not going to work the first time.