**Glossary:**

NRG – Energy

CO2 – CO2 equivalent

**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.

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. 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.xlsm spreadsheets.

**How to run Results/Compare:**

Download all the .xlsm files. In the file manager, set the properties to turn off read-only.

Open each of the “Results…” files, and enable macros. Leave them open.

For example, Results\_CO2\_100\_all.xlsm means $100 per ton of CO2eq, all regions. This notation may change in the future.

On sheet Graph, cell A1, is the region. If you click on it, an arrow appears to the right. Hit this arrow to choose region. EIA divides the country into 13 regions, like CAL for California, MIDW for MidWest. At the top is “Sum\_all”. Next version will have full names here.

Cell A2 is what you are graphing - Cost, Energy (MWh), MTons CO2. All for a CO2 of $100.

To compare, open compare.xlsm. This will open all the Results spreadsheets. Here, A1 and A2 are the same. A3 selects one energy source - All, Solar, etc. that you are graphing.

On both sheets, there is a button which switches between bar graph and line graph.

**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 ½ hour 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.