

1. Describe the project:
  - a. For my project, I wrote a TCP server which would get electricity rate information at a latitude and longitude location of user's choosing from the REoptAPI. When the user runs the program(server and client), the user would be asked to input a latitude and a longitude that points to a location where the user wants to investigate the utility information. After that a utility\_data\_extractor class is created which is meant to extract and store information from the data received from the REoptAPI. The class has 3 methods, store\_info method, get\_brief\_info method, and set\_utility\_rate method. Store\_info method asks for the data dictionary and filename for input parameters. For the data dictionary, it is extracted straight from the API as .json format and the file name is the name for which the user wants to store the information. The data would be stored in .json format under the filename chosen by the user. The get\_brief\_info method returns the keys and values from the data extracted from the API, and it asks only for the data dictionary as the input parameter. The set\_utility\_info asks for data dictionary, and the 3 utility rates for commercial, industrial and residential use as the input parameters. The method allows the user to replace the rates of the utility at the location with their choosing. When running the program, the user would be asked if they want to make the change and if so, the rate that they would like to change to.
2. I selected this project because I know that in the upcoming energy revolution, the technology of microgrids would be implemented globally. Even though my program might not be of much use at the moment, but in the future when I start developing and implementing microgrids I am sure being able to know the electricity rate at location that I am interested in would be extremely helpful to me. In Bronzeville county of Illinois, microgrids were implemented in Feb 9th, and I believe that this program could be quite helpful to them, whether in its state or modified.
3. I initially only chose to use contents from the Keeping and persisting data: structure and tools lecture form week 4 and Networking, APIs, and programming at a distance lecture from week 5. However I want to also further demonstrate and hone my mastery of the Object-oriented programming in depth lecture material so I also included that in my program. The application of API, and the data structure and tools are very important to me as I believe that in this heavily digitalized society, the mastery of API is slowly becoming a common knowledge which all of those who wishes to work with programming should know. The knowledge that I learn from storing and using data files in different format also helps me greatly in dealing with data in the future.
4. If I were to have an opportunity to redo this project, I would definitely try to put all of the program onto an interface (tkinter), because it really gives the users better accessibility of my program. It would also make running the code or using the program more convenient. Another things is that I would also include more methods in my class so that I could improve the versatility of my program.
5. To run my project:
  - a. first, you will need to have both the server and client files downloaded,

- b. Next, you will need to pick a port that is not being used for the server and client to communicate on,
  - c. Next, after you run the server, go to the client and run the client
  - d. Then simply put down the latitude and longitude information(You could use lat=46, long=-87 for testing because the api does not have some of the data at certain locations)
  - e. Then the program would ask if you would like to set the new utility rate,
    - i. if answer yes, the program would ask for the 3 new commercial rates one by one
    - ii. If answer no, the program would simply finish running and quit,
  - f. After you're done answering, there will be a new .json file created in your folder with all the information on it.
6. The project was challenging as the concepts that I have applied in the program are all relatively difficult and I thought that the combinations of them together really took me a lot of time to figure out. There were many things I overcame, such as understanding how the tcp server and client communicate between one another especially the orders at which send and receive, integrating the API and class into the TCP server was also difficult because the addition of all of the information really required me to logically think through the orders for which the codes have to run.
7. <https://github.com/NREL/REopt-API-Analysis/wiki>
  - a. This is the github site of the API I decide to use, and it really explained how to access the API and the information that it provides.
8. In the program, I implemented try and except to handle error during the inputting lat and long values at the beginning. The code would run normally if inputs were of int and float type, but would print input incorrectly and would require the user to pick a new port and run again if incorrect input. Another place at which I input error handling is at the end when the program asks if the user wants to set a new utility rate, the only answers are yes or no, if the user inputs other stuff the program would also print a message and the user would have to run the program again. As for the the extra concept, I used a third concept in the Object-oriented-programming to create an object class that could extract data information from the API and store it.