Problem Definition:

A smart grid is an electrical grid that consists of multiple new technologies, that either operate or measure energy production and consumption, such as smart meters. Smart grids have decreased the carbon footprint by efficiently transmitting electricity, reducing operations and management costs, and reducing power costs for consumers. The Department of Energy estimates by the year 2030 Smart Grids can be credited for reducing CO2 emissions from an approximate range from low, 60 million metric tonnes, to high, 211 million metric tonnes. Although Smart Grids have effectively decreased the average carbon footprint throughout the nation it seems that there is not a system that prioritizes renewable energy resources through all processes of distribution.

Problem Solution:

Our goal is to create a simulation of two power plants, renewable and nonrenewable, and compare their output efficiency. One plant will be similar to PNM which has coal as its majority of its energy mix, while the other will be a plant that uses renewable energy as a majority of it's mix. We will measure transmission loss, carbon emissions impact, and if able, the cost of using different energies. If the output of the renewable sources matches or exceeds the output of non-renewable sources our goal is met.

Progress to Date:

We have begun to familiarize ourselves with the power distribution process. The electricity made by generation stations is sent through transformers to increase voltage for power to reach longer distances. The electrical charge is sent through high voltage transmission lines across the country which then reaches a substation to lower the voltage to be sent to smaller lines. The smaller lines extend into neighborhoods where the electrical charge is sent through another transformer to reduce the voltage and to ensure the power is safe to use in a home. When the power is connected to the home, it passes through a smart meter to monitor how much the home uses. In order to learn how this process applies to New Mexico and the zones the power companies use to route, we have decided to contact PNM and will survey data-sets to implement into our code to find the carbon footprint of PNM's and the selected energy producer's operation. We have chosen to compare PNM's energy mix with Calepine. Additionally, the individual power plant we plan to focus on is The Geysers Geothermal Complex, located north of San Francisco in California, US, with 900MW of active production capacity, which is the world's biggest geothermal power plant.

Expected Results:

By comparing the carbon footprint of PNM and Calepine we expect to see that Calepine has a much lower footprint. However, in regards to power output, we expect Calepine to match the same output as PNM for the same, or lower, costs. In contrast, we expect more energy to be lost from Calpine's energy production than PNM's energy production. We hope this comparison

and data will assist PNM to switch to renewable energy resources sooner. For example, in 2017 PNM reported that its current energy mix was 56.1% coal, 21.8% nuclear, 12.3% natural gas, and had a total of 9.8% renewable energy resources used for power generation such as wind, solar, and geothermal. Moreover, PNM plans to have 100% emissions-free generation by 2040. Once again, we hope this system will induce energy producers, such as PNM, to switch to renewable energy resources sooner.

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