Problem Statement

The World's energy needs are increasing and the availability of fossil fuels is decreasing, meaning that we need to find a solution before it's too late. We are going to specifically take a look at the US and its demands and projections. Although this is a global problem, I presume that a lot of value can be extracted from analyzing the US and could be used beneficially in other countries as well. The fundamental question is what are the projected energy needs for the US in the next 10 years and how much more energy will we need to produce to meet these needs? To be more specific, would this be possible with the use of Solar Energy, at what rate would we need to install solar panels and batteries, what zones have higher energy demands and how does sunshine play a role in all of this? How much surface area would need to be used for all of these solar panels and what would the cost for such a project be as well as the potential return on investment. Solving a problem like this would help significantly with pollution, climate change and many other environmental benefits. It would also allow us to not worry about exhausting finite energy sources such as fossil fuels and set up humanity for a better future.

Context

This project specifically focuses on the US so there may be insights that are relevant for other parts of the world and others that are not very useful. Sunshine in the US is likely greater than in a country like Canada, so this could potentially be a large factor when making predictions for other countries. Countries also have diverse climates, terrains, and surface areas and many other diverse features which could also have impacts on the relevancy of the derived insights. The main focus is to use data on sunlight as well as required land and to project possible price and return on investment. This project also does not consider the feasibility of manufacturing the sufficient amount of solar panels, batteries, maintenance of equipment or account for installation. The primary focus is to crunch the numbers to see if such a project would be theoretically possible.

Criteria for Success

Success would be showing that the return on investment within a 10-30 year period would be positive and that the power produced by the solar panels would be enough to supply 90% of our current and projected energy demands in the US within 10 years and also be able to keep up with the increasing energy needs. The required land should also be 10% or lower of the total area of land in the US.

Scope of Solution Space

The solution space is more about showing the theoretical ability to execute a project such as this. It does not take into account how this project will be funded or how the resources will be collected etc. It will however consider if the amount of money required is feasible and if this investment will pay off within the set time frame of 10-30 years. We are trying to prove

essentially that 1) there is enough land area, 2) the amount of power generated by the panels plus the battery storage will be enough to power 90% of the USs energy demands and keep up with projected demands, 3) The investment will be recovered in a 10-30 year span.

Constraints

One constraint of the project is calculating the required labor. It may be shown that it's feasible to finance a project, that there is enough land area, and that the investment would pay off but perhaps the amount of labor that is required is beyond what we have access to. Another constraint is calculating if there are enough physical materials and resources to build a sufficient amount of solar panels which will not be considered in this particular project. We are also assuming that all of the energy produced by the solar panels will be stored in batteries while in reality, there may be a lack of sufficient battery storage. We are assuming that with the improving technology of battery storage, this problem will eventually be resolved. It's also worth noting that this project is being done using data from the United States and that insights may not apply as much to other countries due to factors such as sunlight, technology, landscape, finances etc.

Stakeholders

The primary stakeholders may be governmental agencies, environmental companies, private investors, local communities and many more. It is hard to predict and name all of the investors in such a large scale project and would require collaboration and input from various groups.

Data Sources

I would use datasets from US Energy generation 2001 - 2022 to predict future energy needs.
https://www.kaggle.com/datasets/kevinmorgado/us-energy-generation-2001-2022

Renewable energy production from 2001 - 2016
https://www.kaggle.com/datasets/mckenziejon/eia-electricity-generation-from-renewables

Sunshine data in different stations in the US for solar power prediction.
https://cmr.earthdata.nasa.gov/search/concepts/C1214584772-SCIOP