



# Analysis of Renewable Capabilities in California

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### Overview

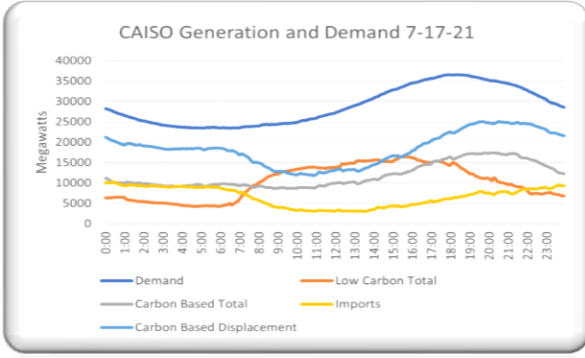
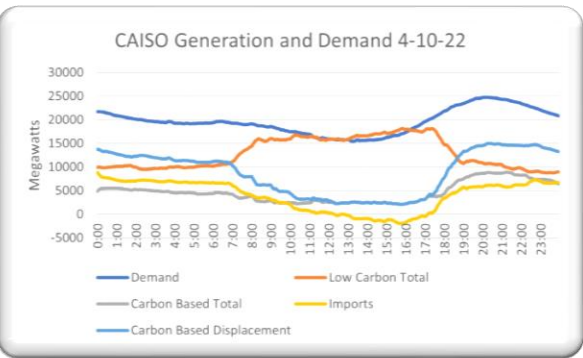
As the world pushes towards replacing fossil fuels with renewables, multiple problems arise with the mass installment of renewables. Simply installing more renewable energy is not a viable means of replacing fossil fuels. This work aims to show why simply increasing renewable energy production is not a capable method of replacing fossil fuels.

### Introduction

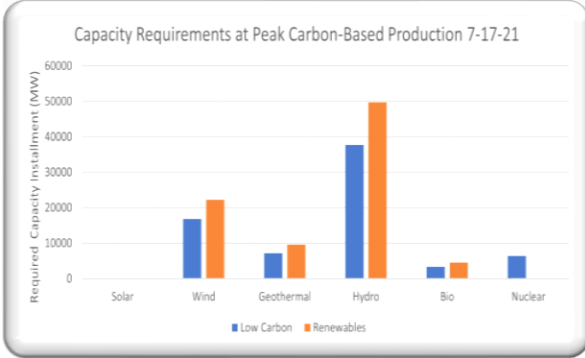
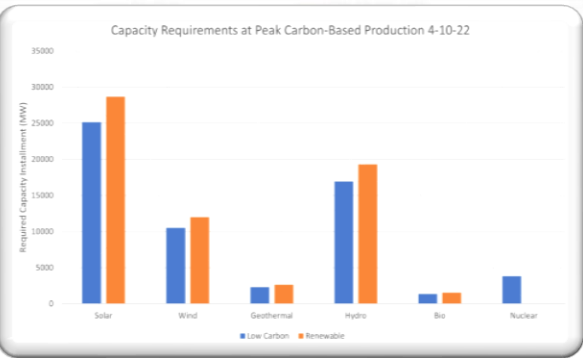
Phasing out carbon-based energy production requires both the increased installment and diversification of renewable energy producing methods due to the inconsistency of their production. California being one of the most energy progressive states has invested heavily in renewables such as solar and wind. Data from the California Independent System Operator was used to calculate the required renewable installments necessary to replace carbon-based energy production on two separate days. The results demonstrated that impractical amounts of installments would be necessary to replace carbon-based energy production. The results make clear the importance of a diverse portfolio of renewable energy producing methods that can better account for the extreme variance in renewable energy production.

### Method

Data was collected from the California Independent System Operator and Energy Information Administration. It was used to calculate the required renewable energy installment to replace carbon-based energy production at the time when its production was highest, for two separate days. The first day, July 17th, 2021, was chosen because it was one of the hottest days of the year in California, so energy demand was very high. The second day, April 10th, 2022, was chosen as a typical late spring day, where demand would be low and renewable production would be high.



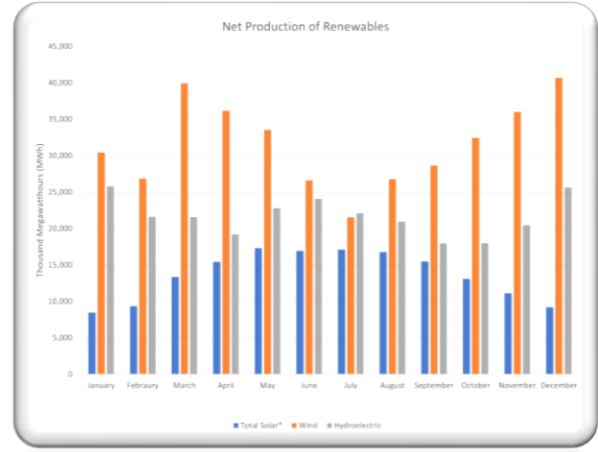
Generation totals by type, demand, and total carbon-based energy production at specific time intervals.



Capacity installments necessary for low carbon and renewable sources to replace carbon-based energy at its peak production.

### Results

The capacity requirement graphs show the enormous amounts of renewable energy that would need to be installed to account for the carbon-based production when it is at its peak. The most significant data point can be seen in the solar capacity installment requirements. Peak demand and peak carbon-based energy production occurred on both days roughly around 8:15, after the sun had gone down and solar panels were no longer producing energy. As a result, carbon-based energy production ramped up to account for the decrease in renewable production. The need for carbon-base energy is further compounded on a yearly basis where renewable production can vary by up to 20,000 megawatts.



Total renewable production in the US throughout the year.

### Conclusion

California has invested billions in renewable solar technology to achieve a solar energy capacity of 15,000 Megawatts. However, with peak demand occurring after the sun has gone down and solar farms are no longer producing energy, the need for fossil fuels to pick up the slack arises. This problem is intensified by the significant variance in renewable production throughout the year. Therefore, increasing renewable installments alone is not a capable method of phasing out carbon-based energy. A large and diverse portfolio of renewable energy producing methods is necessary to better account for the variability in production to phase out fossil fuels.

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