Solar Power Plant Generation ML Prediction Model

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Data Provided by: Kaggle.org, OpenWeatherMap.org

Problem

- Solar panels produce inconsistent amounts of power each day

- How can we estimate how much power a plant with multiple arrays will produce throughout one day? One month? Or one year?

Key Findings

Nominal Operating Cell Temperature

$$T_{Cell} = T_{Air} + \frac{NOCT - 20}{80} S$$

- Determines the temperature of the cell at normal conditions (20°C, 800 W/m² Solar Irradiance, 1 m/s wind velocity

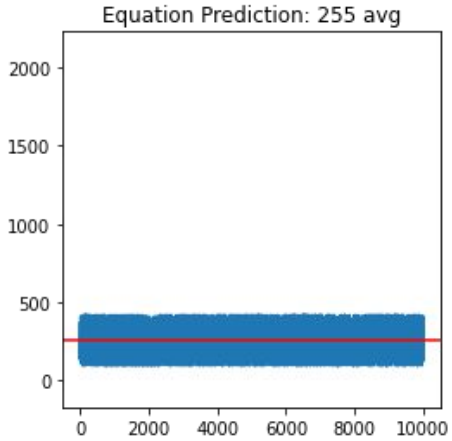
Power Generation Equation

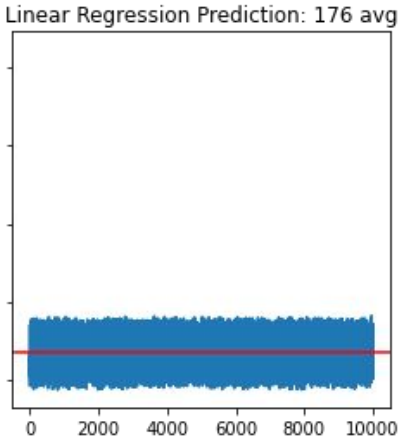
$$ArrayPower = T_{Cell}(C^{\circ}) \cdot a(kW/C^{\circ}) \cdot b(kW/kW) \cdot c(kW/kW \cdot hr)$$

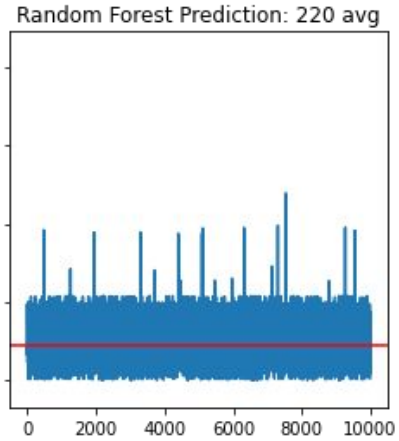
- Converts cell temperature to total output using three conversion coefficients (a: Temperature to AC Power, b: AC to DC Power, c: DC Power to Array Output)

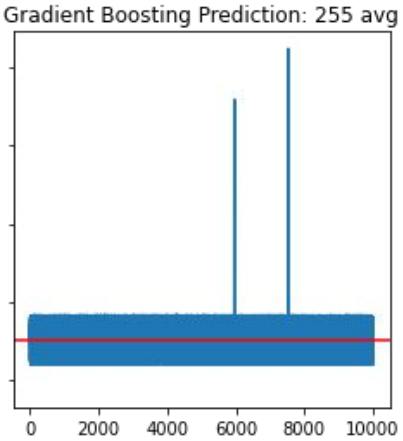
Model and Analysis

- Gradient Boosting with 70 decision trees proved to be the most accurate when compared to equation-predicted results









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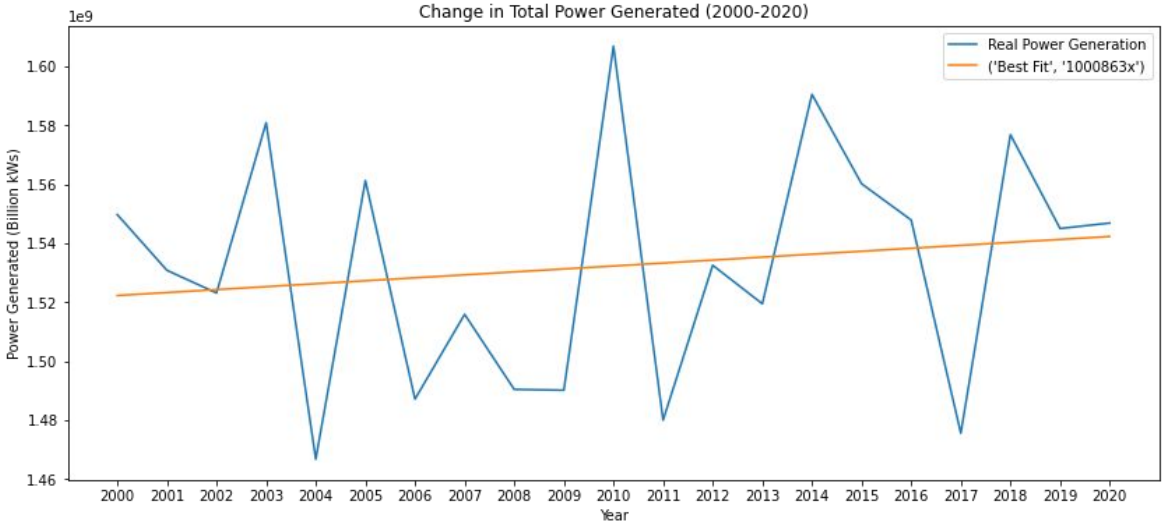
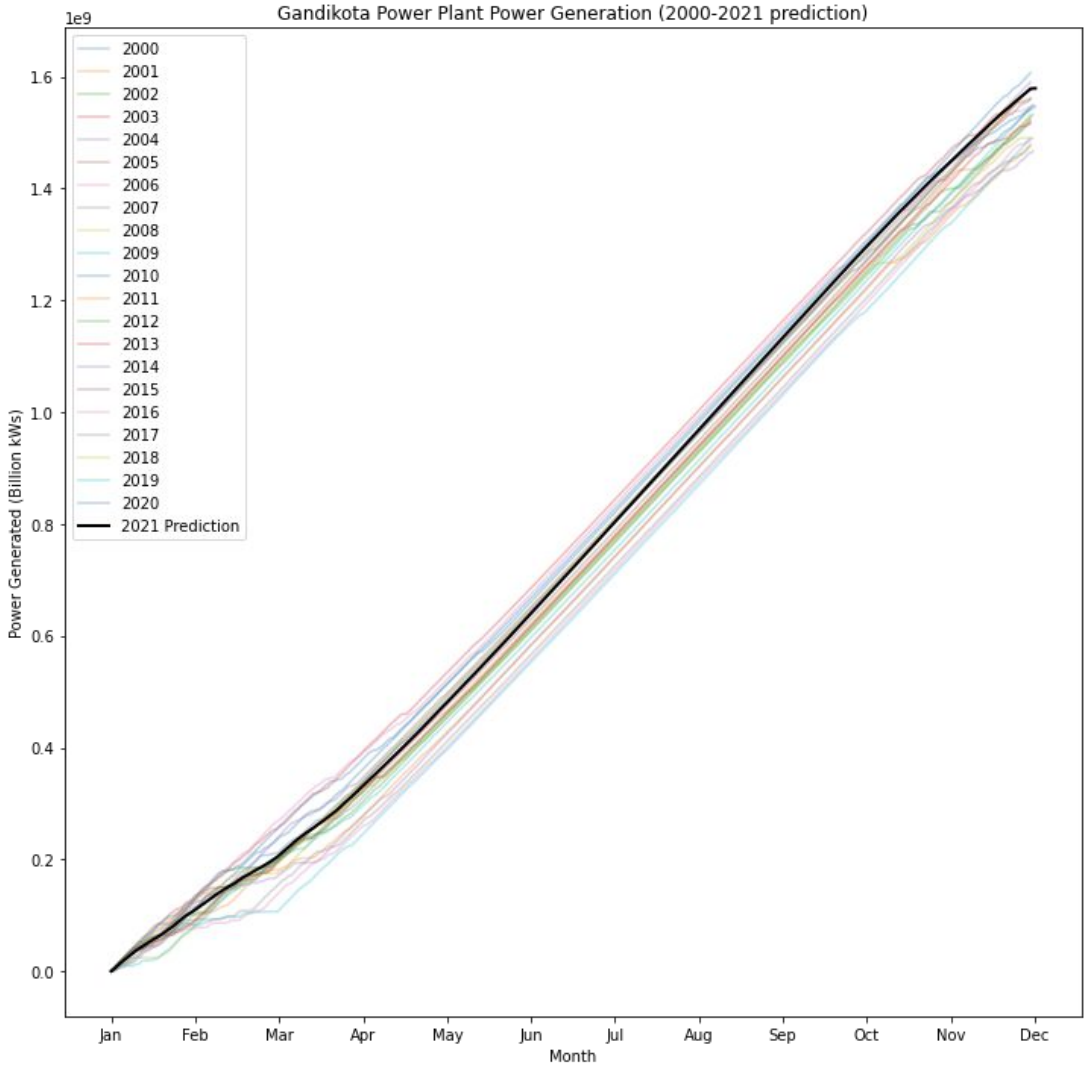


- Downloaded 20 years of historical data from Gandikota - applied the model to determine the power output

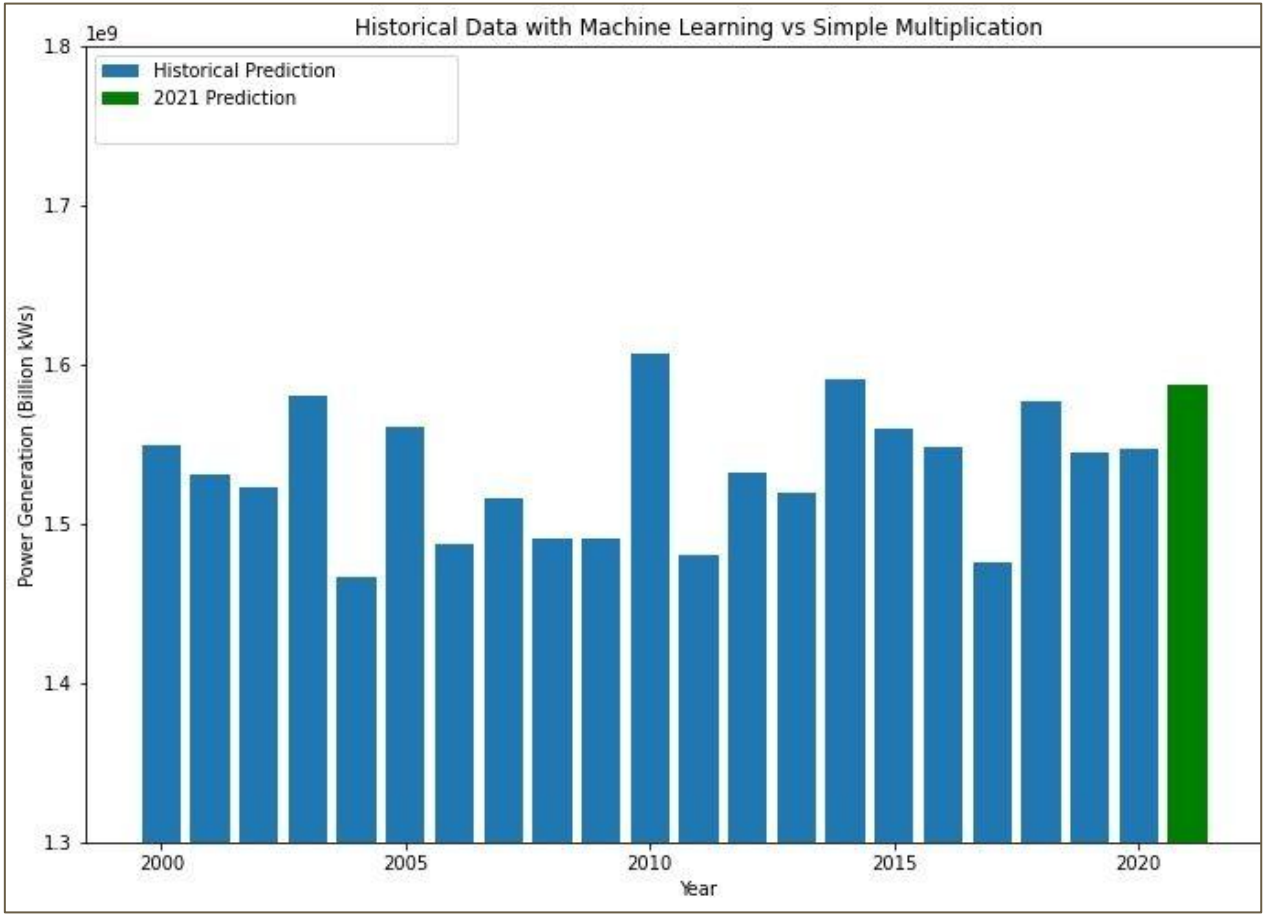
- Total generation has a positive trend of + 1,000,863 kW/hr per year

2021 Power Prediction

- 1.58 Billion kW/hrs

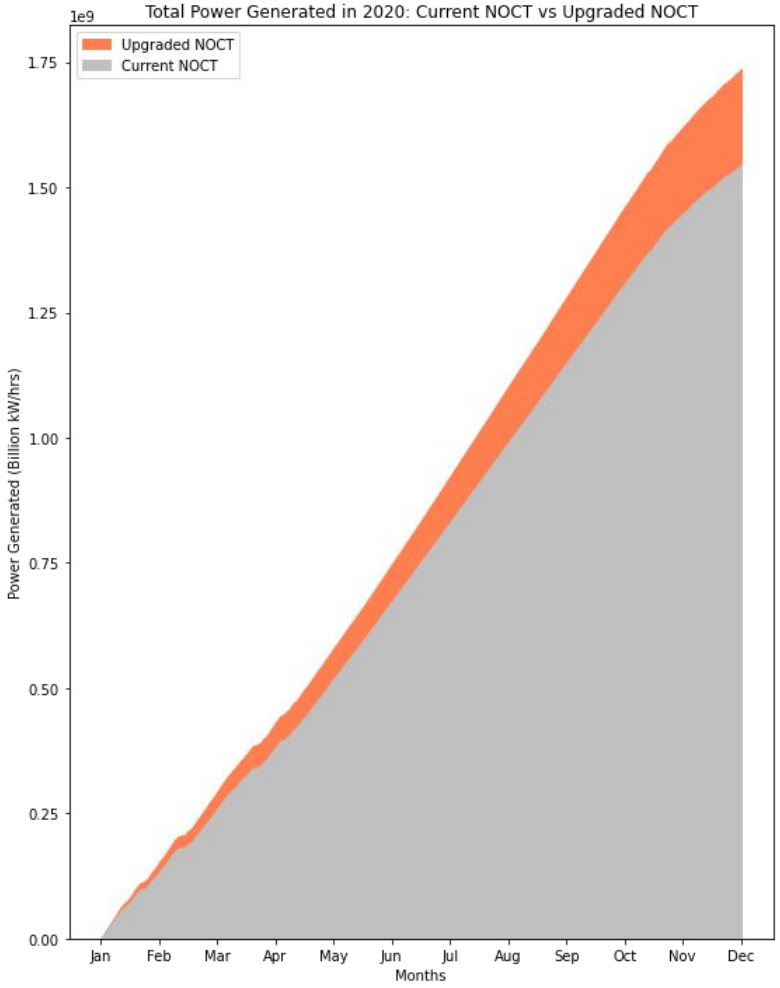


Predicted output compared to previous years



Recommendations

- Current NOCT is around 18, industry average is at 48
- Upgrade solar arrays to improve efficiency
- Over one year upgraded arrays will generate:
  - 191,000,000 kW/hr additional power
  - $6,300,000 additional revenue



Conclusion

- The Gandikota Power Plant has lots of potential to generate even more green energy with upgraded solar arrays.

- Investing in upgraded technology will help push the power plant and its competitors towards a **green future**. Additional revenue will also lead to higher salaries for employees and possible expansion opportunities

Thank You!

Questions?