

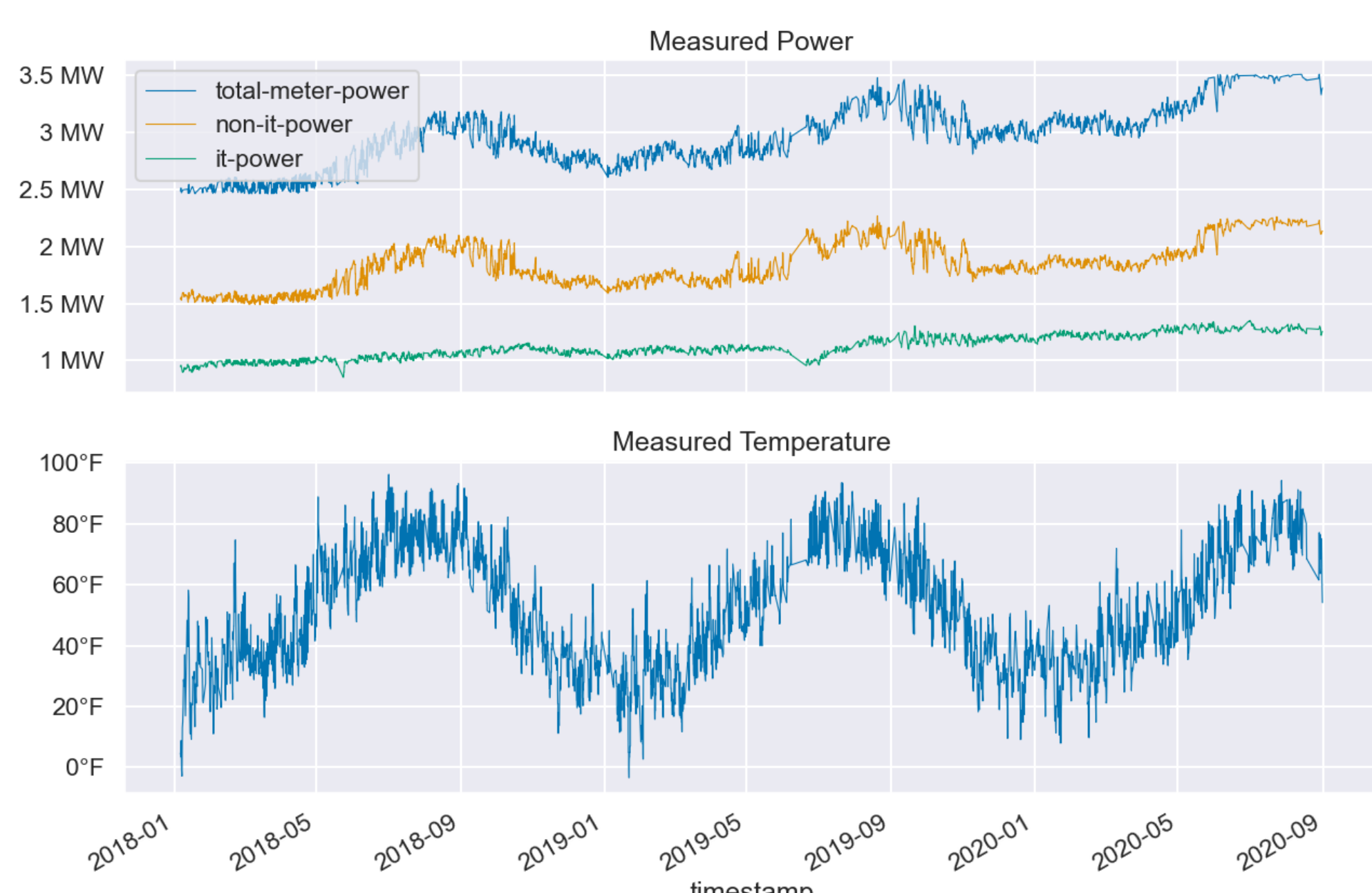
Using IT Power and Outdoor Temperature Data to Predict Total Power Consumption

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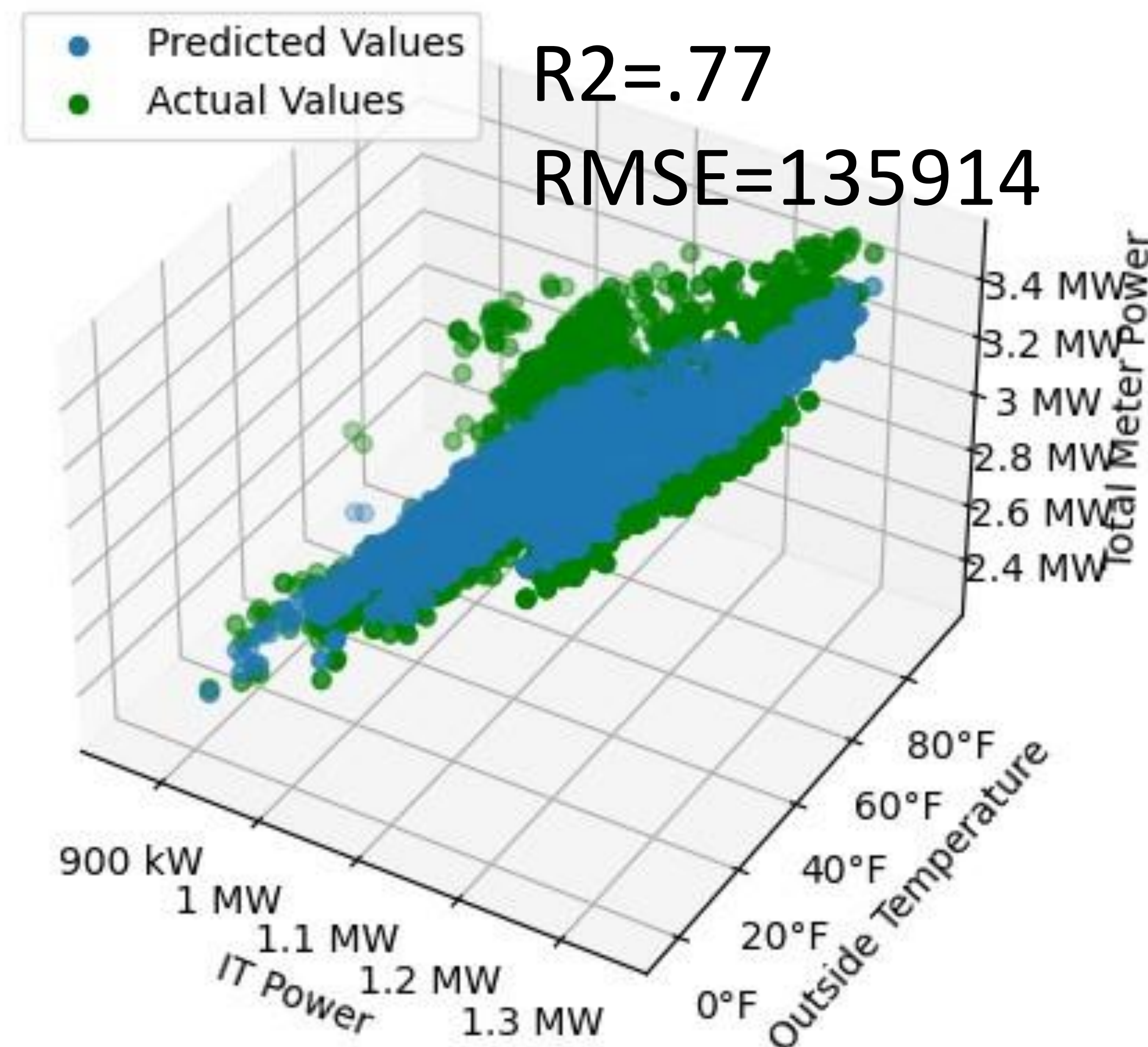
Introduction

- Data centers consume more than 3% of the electricity in the US.
- Data centers have to purchase this power from power providers.
- Data centers have to specify how much power they will need to purchase (this amount is called the target value).
- Data centers need to predict the target value accurately otherwise they end up spending too much money or don't spend enough for their power.
- The target value can be predicted using a linear regression model and two inputs: IT power and outdoor temperature.

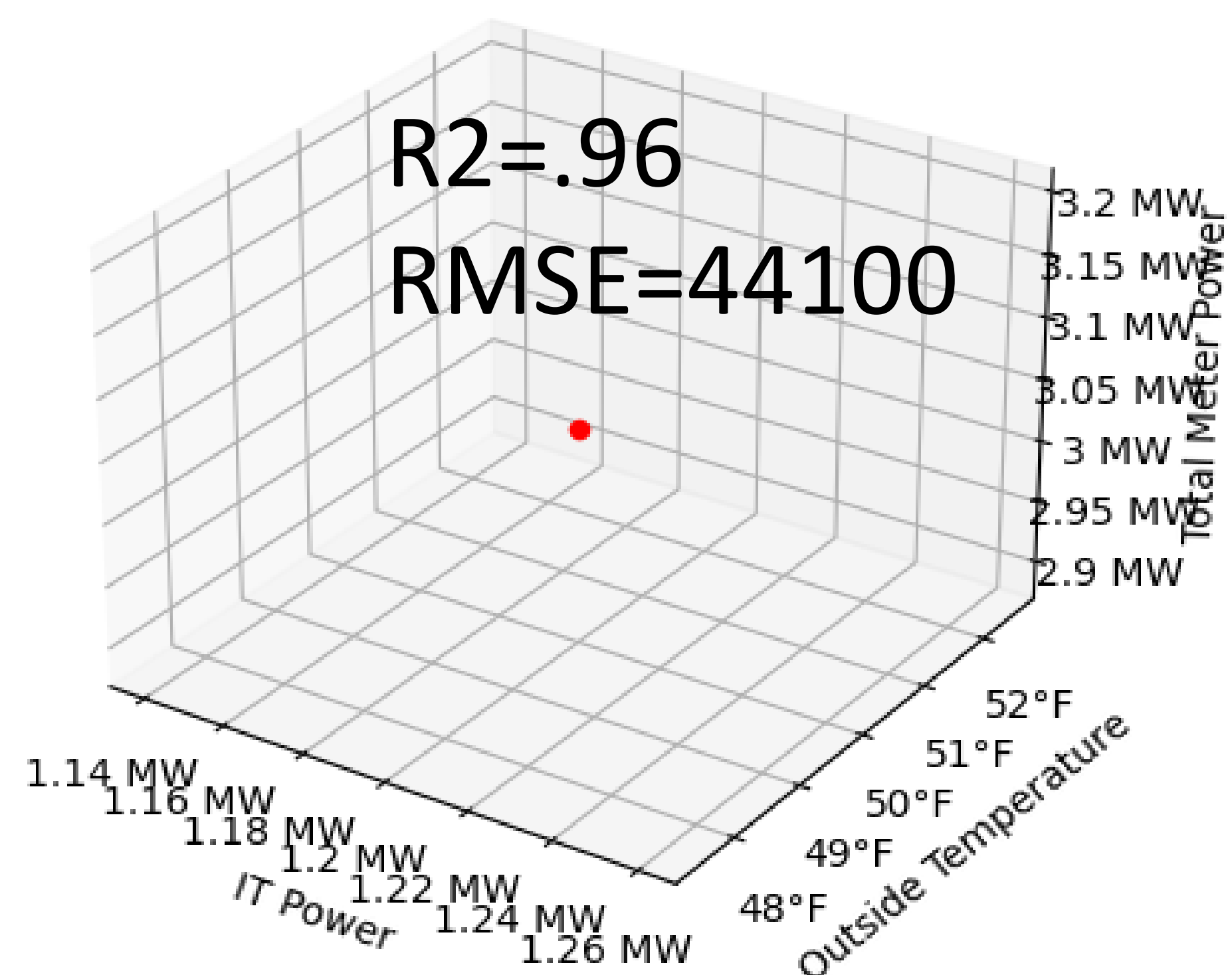


Results

Graph showing the 3D relationship between outdoor temperature, IT power, and total meter power.



```
predict_Total_Meter_Power(50, 1200000)
Total Meter Power Prediction: 3043157.091 MW
```



Prediction function takes in temperature and IT power as parameters and outputs the prediction on a 3D graph and in text.

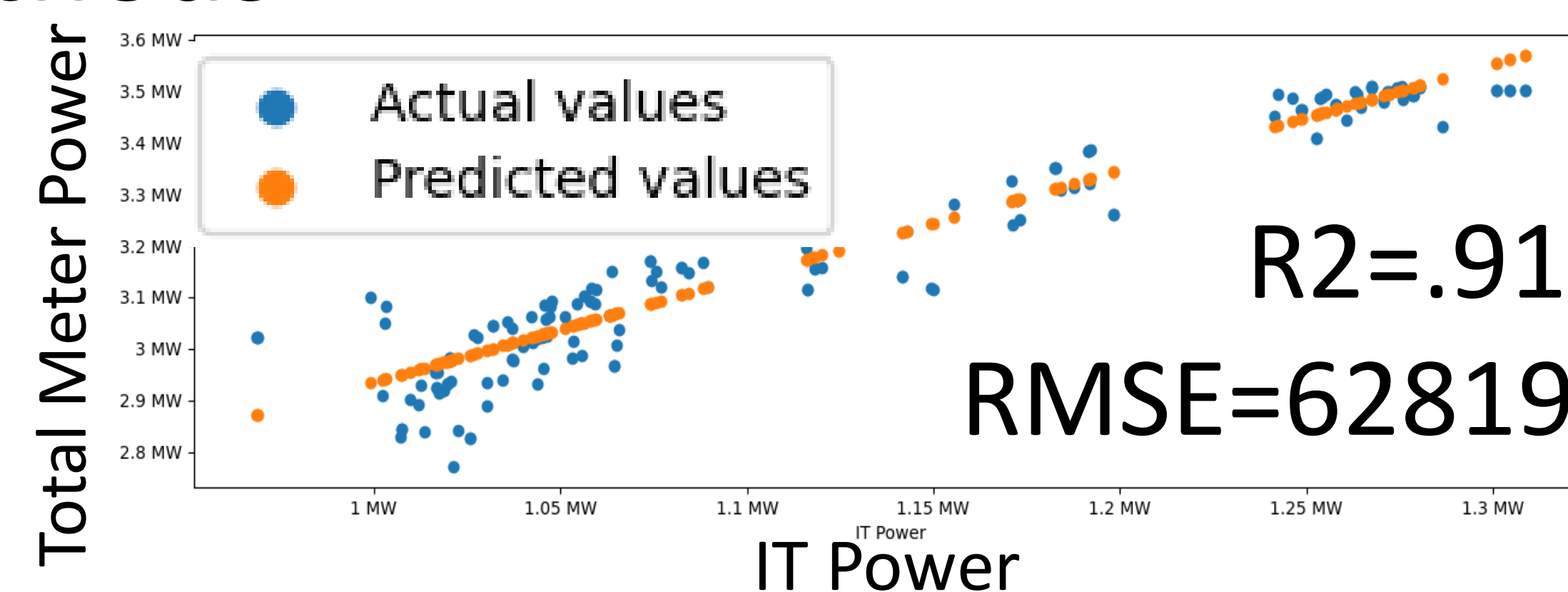
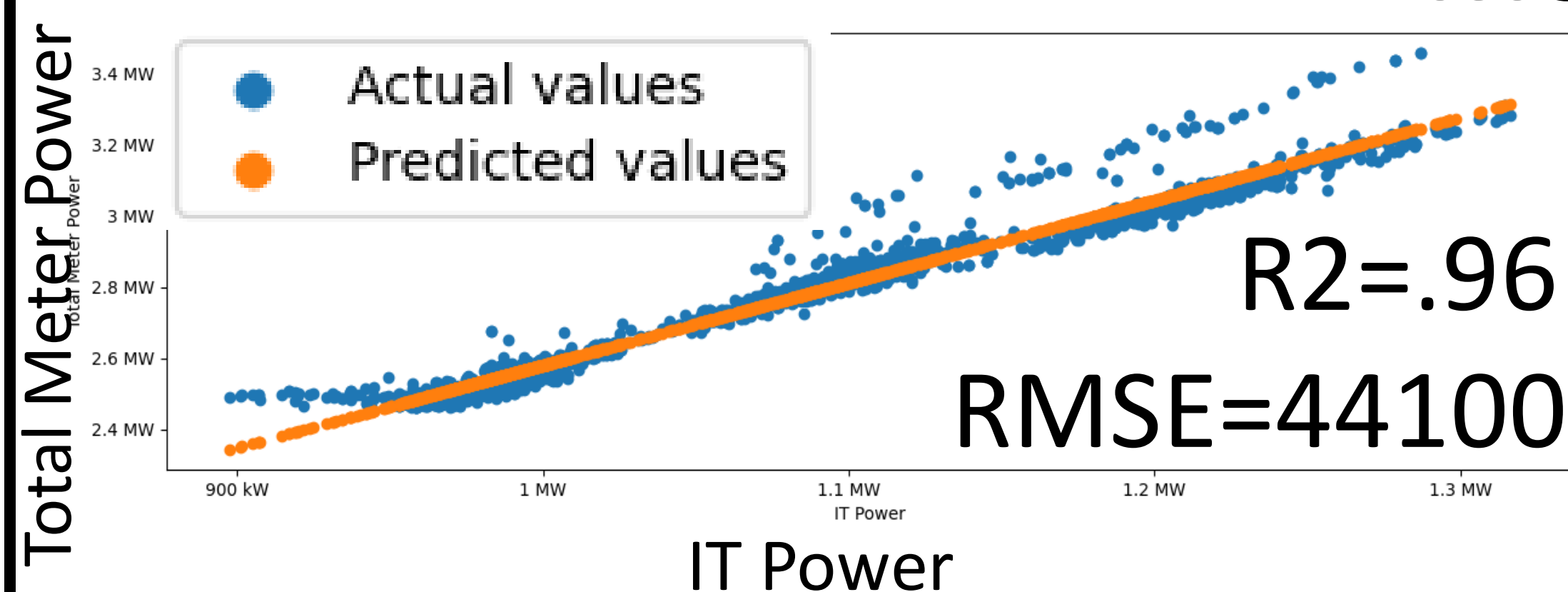
Discussion/Conclusions

- The prediction function developed has proven to be accurate, with an R2 score range from .77 to .96.
- The range of R2 scores was made possible by splitting the data into different parts according to the outdoor temperature values.
- The prediction function ensures that data centers will be able to accurately predict and purchase the right amount of power from the power provider.

References

- [1] Ayse Coskun. Data Centers in the Smart Grid. *Circuit Cellar* **2014**, 286.
- [2] Yijia Zhang; Daniel C. Wilson; Ioannis Ch. Paschalidis; Ayse K. Coskun. A Data Center Demand Response Policy for Real-World Workload Scenarios in HPC. **2021**, In *Design, Automation and Test in Europe Conference*.

Methods



Used the Least Absolute Shrinkage and Selection Operation (LASSO) to generate multiple different graphs (according to outdoor temperature value) with different R2 values to obtain better training and testing accuracies. Used LASSO to fit the training data to the linear regression model in order to get testing data predictions.

Acknowledgements

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