IST – 687 Final Project

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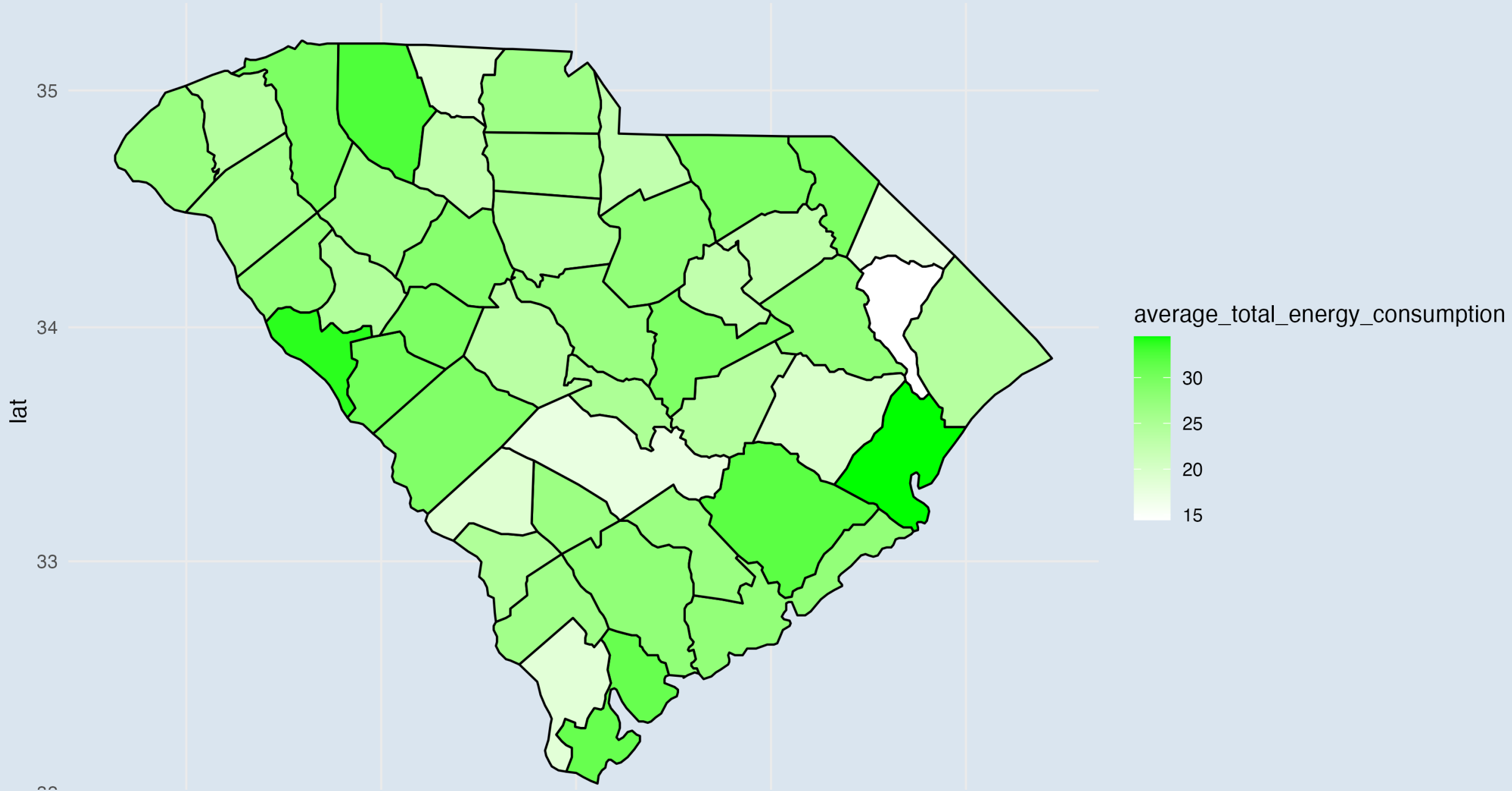
Introduction

- eSC is a power company that provides power to South Carolina and some of North Carolina

- They are worried that due to global warming, next summer may put too much strain on their electrical grid

- They want to find out the key drivers of energy usage, to encourage users to save energy

- They want a prediction of how much energy will be used if summer next year is hotter
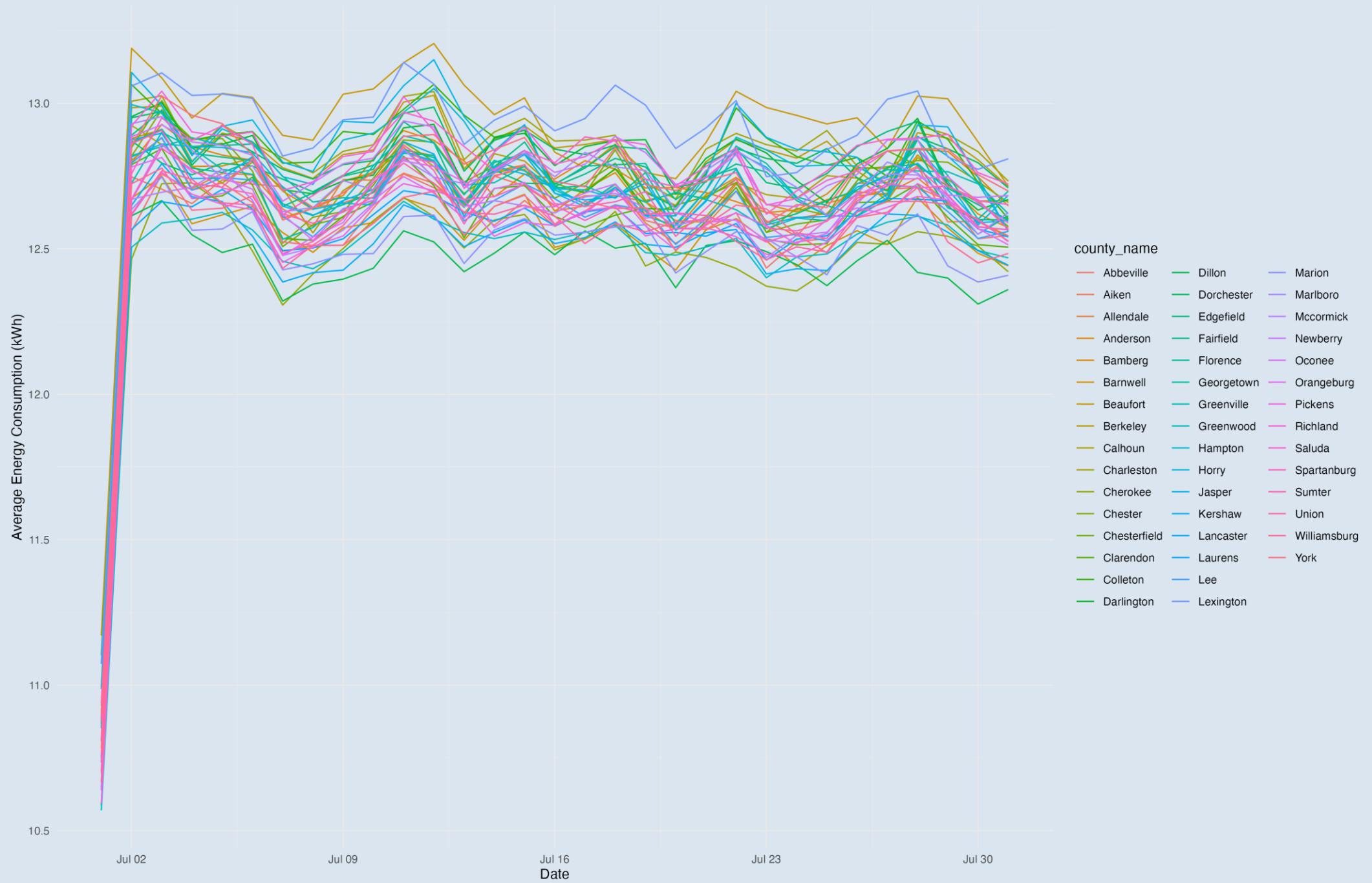
The Data We Used

- Prepped and cleaned data

- Merged houses with their energy usage data

- Able to match weather data with each house
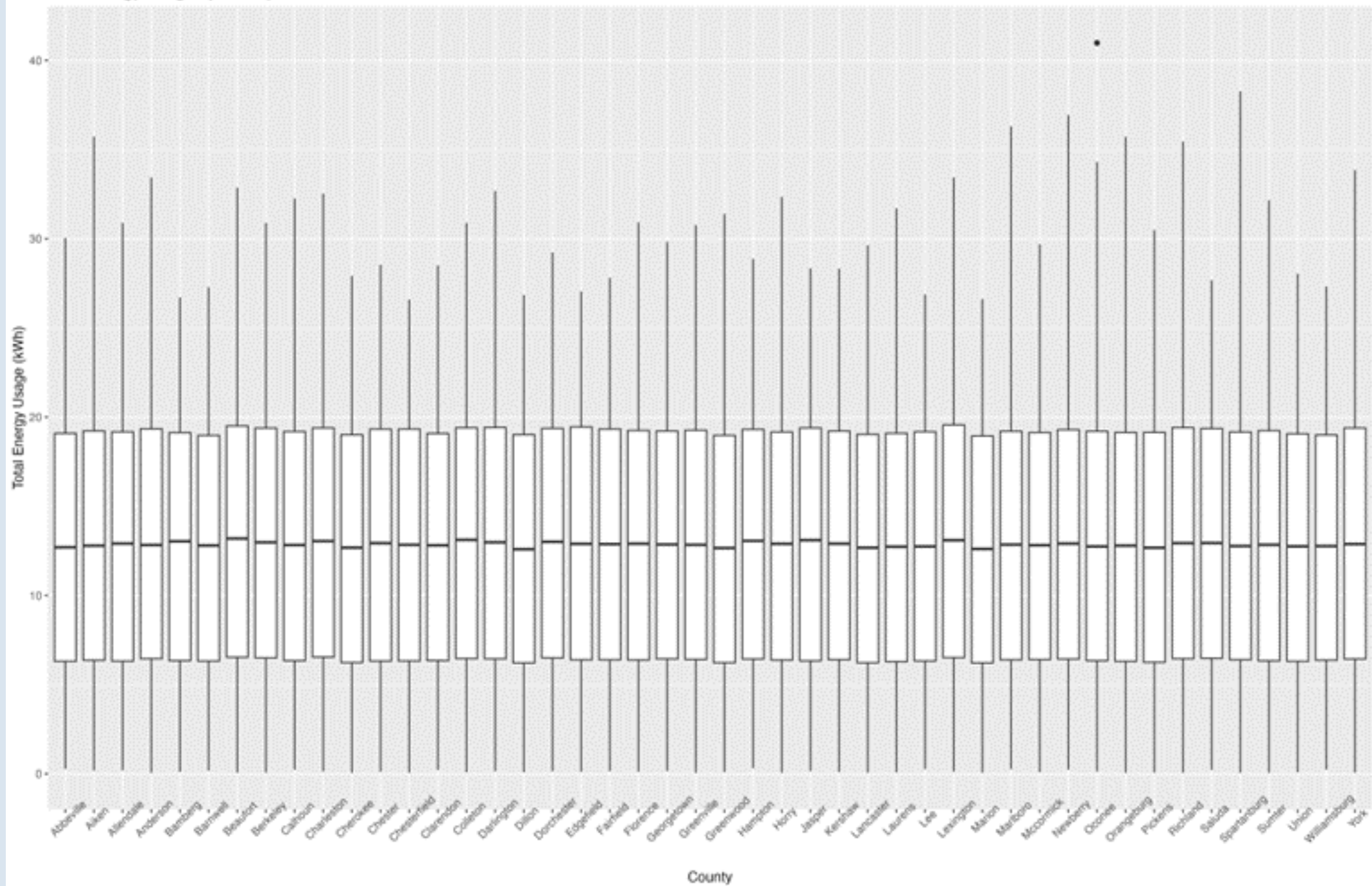
- Allowed us to see energy usage by the hour

Energy consumption in South Carolina

Average Daily Energy Consumption for each County

county_name

|		
Abbeville	Dillon	Marion
Aiken	Dorchester	Marlboro
Allendale	Edgefield	Mccormick
Anderson	Fairfield	Newberry
Bamberg	Florence	Oconee
Barnwell	Georgetown	Orangeburg
Beaufort	Greenville	Pickens
Berkeley	Greenwood	Richland
Calhoun	Hampton	Saluda
Charleston	Horry	Spartanburg
Cherokee	Jasper	Sumter
Chester	Kershaw	Union
Chesterfield	Lancaster	Williamsburg
Clarendon	Laurens	York
Colleton	Lee	
Darlington	Lexington	

Average Energy Consumption (kWh)

Date

Total Energy Usage by County

XGBoost Model

- Powerful statistical tool used to create a model to predict total energy consumption based on data

- Able to tell us which factors contribute the most to the total energy consumption of a house

- Can change temperature to predict total energy usage in case of temperature change

Peak Energy Demand by Hour and Region
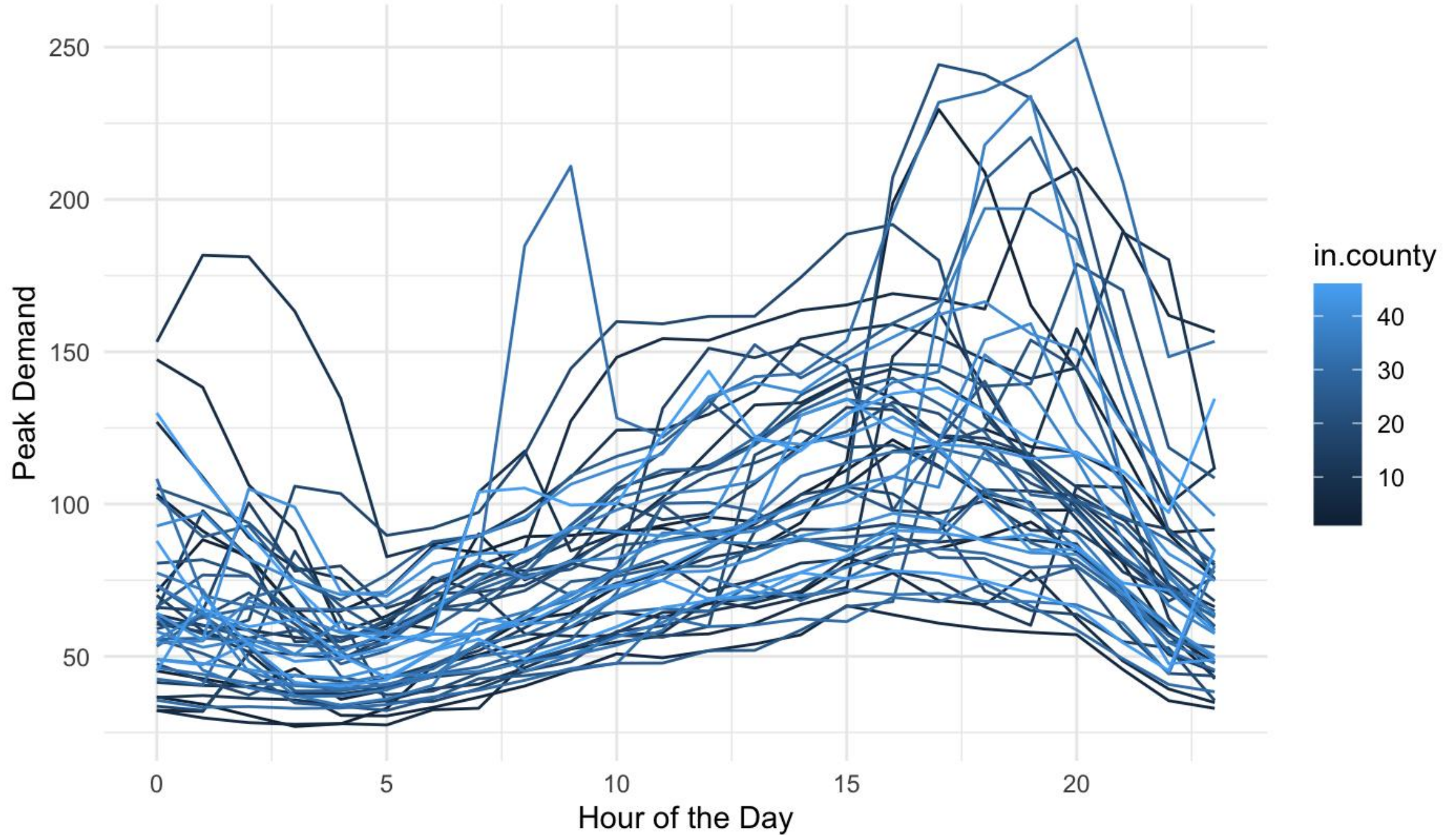
XGBoost Model
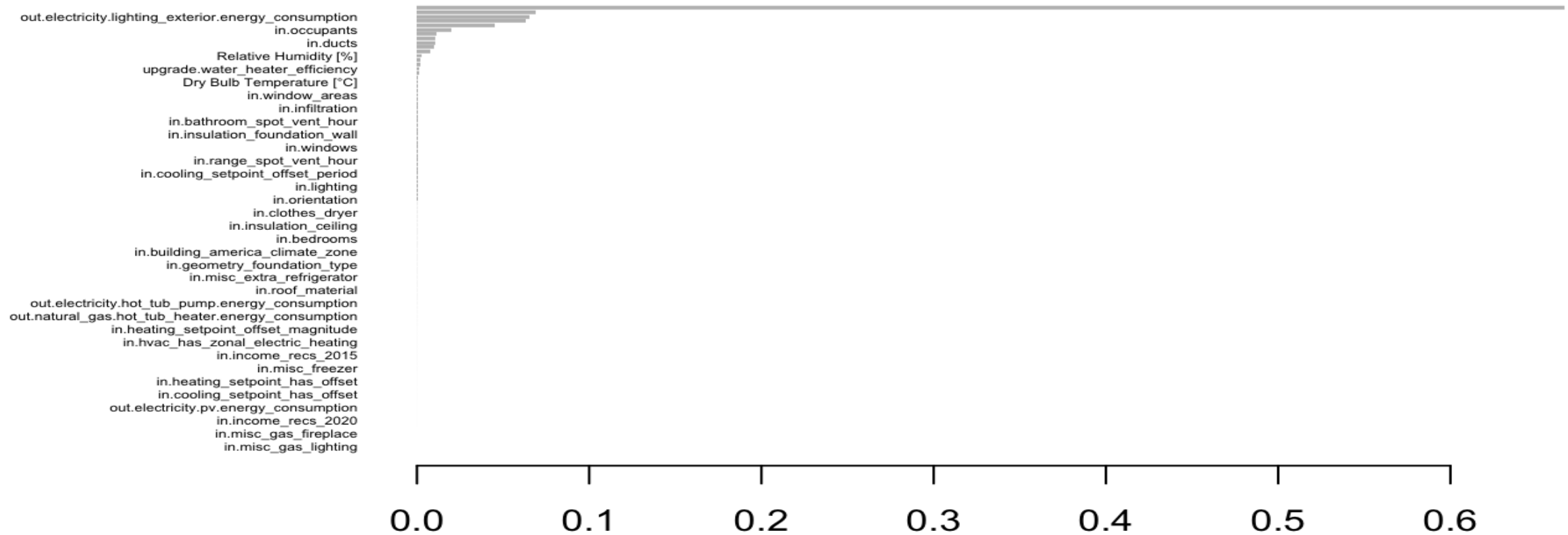
XGBoost

- Feature Significance: The plot shows the relative importance of various factors that affect energy consumption, with the length of the bar representing the strength of influence.

  Exterior Lighting: The factor 'out.electricity.lighting_exterior.energy_consumption' has the longest bar, indicating it is a significant predictor of overall energy consumption.

- Occupants Count**: The number of occupants in a building ('in.occupants') also appears to be an important predictor, suggesting that energy usage increases with more residents or users.

- Environmental Factors: 'Relative Humidity (%)' and 'Dry Bulb Temperature [°C]' are environmental factors that show notable influence on energy consumption.

- Building Features: Various building features such as water heater efficiency, window attributes, and insulation type are identified as impactful, pointing towards the potential for energy savings through building improvements.

- System Usage: Specific system usage like 'in.range_spot_vent_hour' and 'in.cooling_setpoint_offset_hour' are important, which may reflect behavioral patterns in energy usage.

- Energy Sources: Consumption of natural gas and hot tub pump energy are significant, suggesting that these are areas where energy optimization efforts could be impactful.

Policy Suggestions

- Energy-Efficient Exterior Lighting: Since exterior lighting appears to be a significant factor, policies could mandate the use of energy-efficient lighting options for the exterior of buildings, like LED lighting, or the installation of motion sensors to reduce the time lights are on when not needed.

- Occupancy-Based Controls: Implement building codes that require occupancy sensors and timers in both residential and commercial buildings to automatically turn off lights and electronics when spaces are unoccupied.

- Incentivize Insulation Upgrades: Provide tax credits or rebates for homeowners and businesses that improve insulation in walls, attics, and foundations to reduce heating and cooling demands.

- Smart Thermostats: Encourage the installation of smart thermostats that can adjust the cooling and heating setpoints based on occupancy and weather patterns to optimize energy use.

- Water Heater Efficiency Standards: Set higher efficiency standards for water heaters or offer incentives for upgrading to more efficient models, including on-demand or tankless water heaters.

CONCLUSIONS

By identifying the factors that consume the most energy using the XGboost model

South Carolina and ESC will then implement energy saving initiatives related to the most significant factors highlighted by the policies above.

Using the conclusions drawn from the charts and models we created, we can estimate how much power is required per hour daily and see how temperature affects usage.

South Carolina should be able to comfortably predict and prepare for increased energy usage using this data.

Thank you