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Stat 363 Project

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Question: What is the prevailing distribution pattern of power plants categorized by fuel type within the United States? What is the relationship between the commissioning year and power plant capacity? Does plotting commission year against capacity(MW) provide valuable insights into the evolution of power generation infrastructure?

Base R Graph:

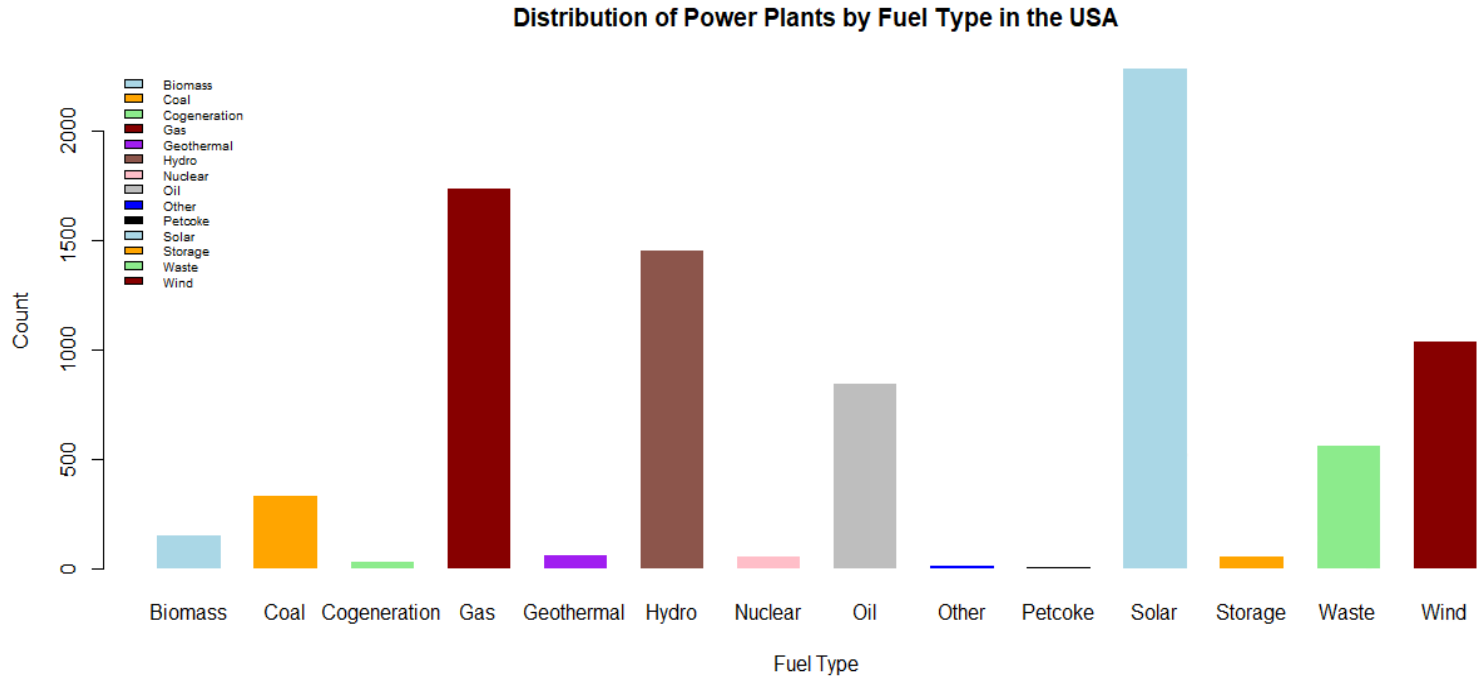
```
usa_power_plants <- subset(power_plant, country == "USA" &
!is.na(primary_fuel))
count_table_usa <- table(usa_power_plants$primary_fuel)
colors <- c("lightblue", "orange", "lightgreen", "darkred", "purple",
"#8c564b", "pink", "grey", "blue", "black")

barplot(count_table_usa,
        main = "Distribution of Power Plants by Fuel Type in the
USA",
        xlab = "Fuel Type", ylab = "Count",
        col = colors, border = "white",
        legend = rownames(count_table_usa),
        args.legend = list(x = "topleft", bty = "n", ncol = 1,cex =
0.6, fill = colors),
        space = 0.5)

cleaned_data <- power_plant %>%
    filter(country == "USA" & !is.na(commissioning_year) & !is.na(capacity_mw))
```

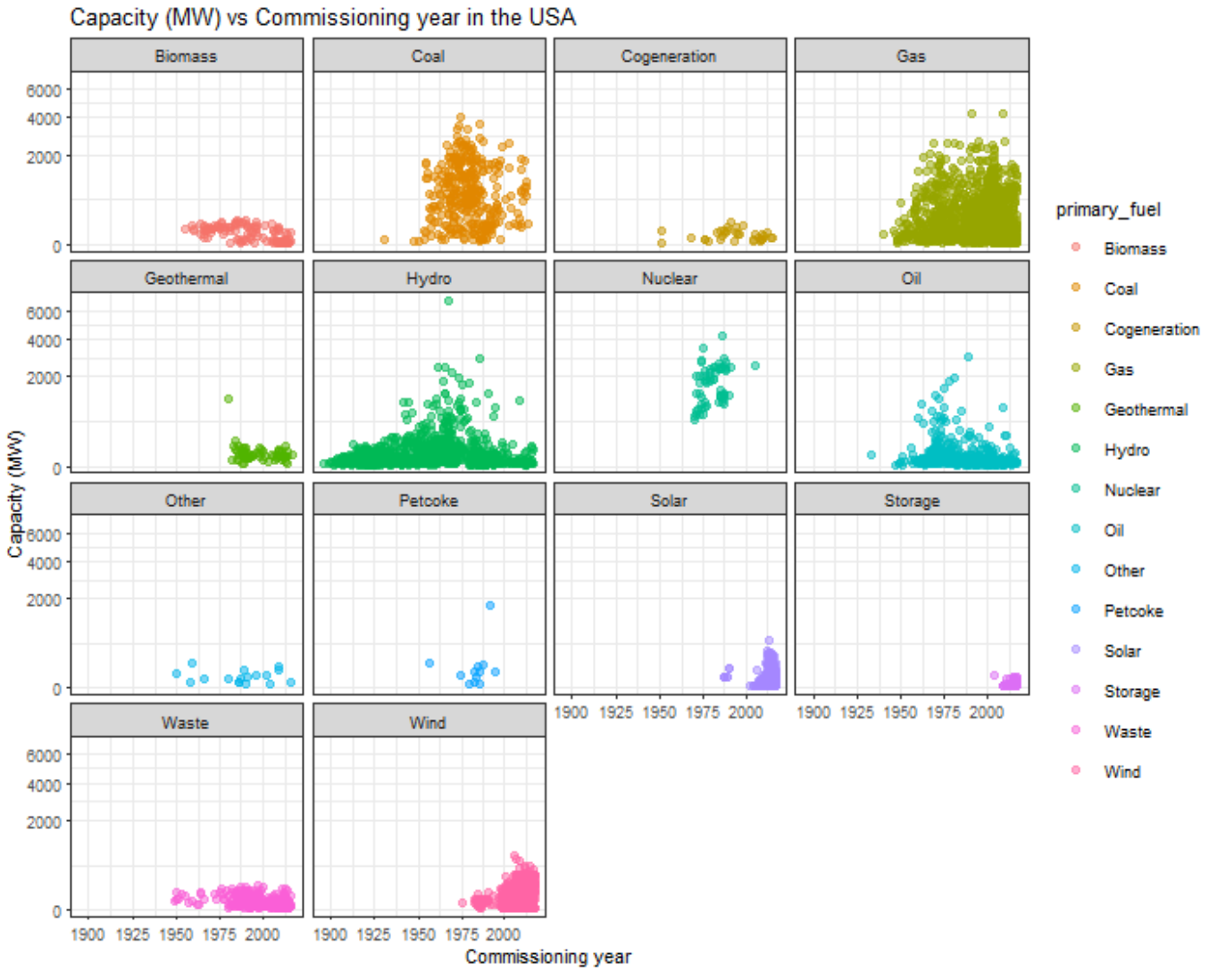
Ggplot Graph:

```
ggplot(data = cleaned_data, aes(x = commissioning_year, y =
capacity_mw, color = primary_fuel)) +
    xlab("Commissioning year") +
    ylab("Capacity (MW)") +
    ggtitle("Capacity (MW) vs Commissioning year in the USA") +
    theme_bw(base_size = 8) + geom_point(alpha = 0.5) +
facet_wrap(primary_fuel~.) + scale_x_log10() + scale_y_sqrt()
```

Notes:

-MW = megawatt.
-Count = power plants
-Commissioning year refers to when a power plant becomes functional referring to the beginning of its act of service


Distribution of Power Plants by Fuel Type in the USA
Biomass
Coal
Cogeneration
Gas
Geothermal
Hydro
Nuclear
Oil
Other
Petcoke
Solar
Storage
Waste
Wind
Count
0
500
1000
1500
2000
Biomass
Coal
Cogeneration
Gas
Geothermal
Hydro
Nuclear
Oil
Other
Petcoke
Solar
Storage
Waste
Wind
Fuel Type


Capacity (MW) vs Commissioning year in the USA
Biomass
Coal
Cogeneration
Gas
Geothermal
Hydro
Nuclear
Oil
Other
Petcoke
Solar
Storage
Waste
Wind
Capacity (MW)
0
2000
4000
6000
1900
1925
1950
1975
2000
Commissioning year
primary_fuel
Biomass
Coal
Cogeneration
Gas
Geothermal
Hydro
Nuclear
Oil
Other
Petcoke
Solar
Storage
Waste
Wind

Write-Up/Observations:

In this project we looked at two different parts of fuel type emissions, one for power plants and the other for varying capacity measurements in megawatts. In the first graph, it is discussed how the different fuel types are affected by the varying amounts of power plants in the United States. Each bar indicates the specific fuel type, and their corresponding heights respond to the amount of power plants that are being used for each fuel type from count 0 to 2000. According to the graph solar fuel has the most power plants used of over 2000 count. The lowest fuel type is petcoke at 0-5 count range. Solar fuel is a renewable source of energy, a very open and clean source, which helps keep climate change under control. This also reduces greenhouse gas emissions which in turn helps the environment on a global level.

For the second graph we used the different fuel types to understand the relationship between capacity and commissioning year. Commissioning year helps determine the year, the specific fuel type was used and in what certain capacities. Here we can see how the results provide us with information about the power generation infrastructure. Looking at the graph, we can see that there is a histogram of all the different fuel types. According to the observations, we can see that coal, gas, hydro and oil have the most running capacities hitting maximum results of up to 4000-6000 megawatts. From the year 1900s to date hydropower has been on a rollercoaster of usage as time passed. From 1950 to date, coal gas and oil capacities have been increasing. The reason for this is due to the nature of their usages. Coal is very much used in the United States as a fuel for electricity. This is a process of combustion from heat, and high pressures from water to generate electricity for the nation. Gas and oil is also readily used in order to power our transportations such as cars, buses, airplanes, etc. The nation uses transportation as its necessity in order to perform our day to day activities. Finally hydropower as it provides clean water and controls water levels in terms of flooding and other damages. This type of power is run on fossil fuels so it prevents release of gasses, aiding against climate change. In turn, the fuel types which are needed for day to day uses will be used more as compared to those fuel types which are not needed or not required for use such as petcoke and cogeneration.

All in all as the need for specific power plants increases depending on their usages so do their respective capacities. Solar power is most in demand for now providing clean and renewable energy sources. Now as time changes, the results may be different. We saw how much hydropower was used back in the 1950s but not as much today as compared to its rivals; coal, gas, oil. For those specific power plants, as commissioning year increases so do its capacities. The one main consideration this all comes down to is usage, where it is being used, how and what are its effects will all play a role from time and time on again, so with new technology and the environment constantly changing, it is a horizon that is yet to be seen.