

## **Executive Summary- Enhancing Fuel Efficiency for Premium Gasoline Vehicles**

**Overview:** This project is focused on advancing fuel efficiency for vehicles powered by premium gasoline. By examining extensive data over seven years, including attributes such as engine size, cylinder count, horsepower, weight, and acceleration, we aim to elevate both environmental sustainability and General Motors' market competitiveness.

### **Analytical Approach:**

**Predictive Models:** Two main predictive models were utilized:

- **Linear Regression Model:** Showed strong predictive capabilities for forecasting fuel efficiency, highlighted by high R-squared values. This model was crucial in understanding the linear relationships between vehicle specifications and fuel efficiency.
- **Decision Tree Model:** Provided a valuable alternative by capturing non-linear relationships and interactions that the linear model could miss. Though initially less effective, this model was optimized through feature selection, enhancing its predictive accuracy.

### **Key Insights and Optimization Strategy:**

- **Fuel Type Analysis:** Identified that vehicles running on premium gasoline exhibit more potential for efficiency improvements.
- **Optimization Focus:** Centered on adjusting engine size, cylinder count, horsepower, weight, and acceleration to reduce fuel consumption effectively using linear programming techniques.
- **Impact:** The strategic modifications in vehicle specifications led to a significant reduction in fuel consumption by about 16%.

### **Challenges and Limitations:**

- **Data Limitations:** The analysis was based on data from the past seven years, potentially overlooking newer advancements and trends.
- **Model Assumptions:** The optimization assumed that solutions would fit within predefined bounds, which might not always align with real-world scenarios.

### **Conclusion and Future Directions:**

This analysis lays a robust foundation for General Motors to significantly enhance the fuel efficiency of vehicles using premium gasoline. The project not only supports GM's compliance with efficiency standards but also fosters innovation in vehicle design, propelling the industry towards sustainable practices. Future efforts will focus on incorporating more recent data and expanding model capabilities to continue driving improvements in fuel economy and vehicle performance.

### **Real-Time Relevance:**

- **Market Demands:** Aligning with increasing consumer and regulatory demands for higher fuel efficiency and lower emissions.
- **Technological Advancements:** Integrating newer technologies and data analytics techniques to continually adapt and refine vehicle designs.
- **Sustainability Goals:** Supporting broader environmental goals by reducing fuel consumption, thereby decreasing overall carbon footprint.