**Assessing the Impact of Banning Internal Combustible Engines (ICE) on California Emissions**

DATA 621: Fall 2020 Final Project

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# Abstract

# Key Words

Carbon-Dioxide, ICE, Emissions, Vehicle, California

# Introduction

Climate change—the impact of manmade activities on greenhouse gases and their role in changing the climate—has emerged as a top priority for most Americans in 2020 (Nadia, 2020). While the global scientific community has had consensus since the 1990s, the economic impacts of climate change have been thrust to the forefront with the NRDC reporting nearly $1.9 trillion dollars in losses by 2100 if no action is taken (Hope & Alberth, 2008). Such economic and devastating loss is most apparent in California, the most populous state in the United States, where the record heat has pushed extreme summer temperatures to 2.5 degrees warmer than that of 1970, and combined with drought, has made the state a seasonal matchbox for wildfires. In fact, during the 2020 year, California has suffered from six of it’s largest and most devastating wildfires (Rust & Barboza, 2020).

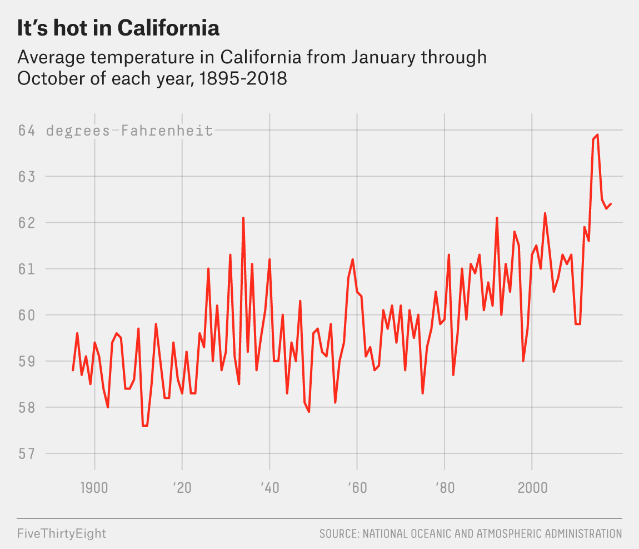


Figure 1 California Temperatures (Christie Aschwanden, 2018)

With such dire consequences on the horizon, California Governor Gavin Newsom signed an executive order in September 2020 to ban all new internal-combustible engine vehicles (ICE) by 2035, and an outright ban on sales by 2045 (Newsom, 2020). California has long been on the forefront of clean energy, having maintain its own stricter gasoline standard CARBOB, a zero-emission vehicle (ZEV) standard, a separate low-carbon fuel standard incentive on all power generation (LCFS) and even tighter vehicle emission standards (CAA Section 909, with the aforementioned setting nation wide vehicle standards and also earning the ire of the 2020 EPA administration (Tabuci, 2018). While the transition to zero emission or electric vehicles is more pronounced in Europe and not the United States, Newsom’s outright ban serves as the strongest salvo for any United States state on combatting climate change.

Given the recentness (at the time of this report’s writing) of Newsom’s ban, the question of what impact would the ban of ICE engines have on meaningful reduce carbon dioxide emissions in California. Our team seeks to help shed light on different scenarios, and more importantly quantify said carbon dioxide emissions, using generalized linear models on vehicle data set. Such a model would not only be powerful for assessing California’s progress towards a lower carbon future but also serve as a tool for policy makers in other states, to evaluate the efficacy of similar program.

# Literature Review

Emissions is an active area of research, and both the industry and scientific community have a rich history of empirical, policy and simulations to analyze tail pipe emissions. Some researchers focused on point representation of cars and focused on their actual physical characteristics to build generalized linear models or stochastic models parameterized by air resistance, rolling resistance and other physical aspects (Fontaras & Panagiota, 2011). Alternatively, others built a simplified linear model using variables such as mass of car, engine out-put and fuel type, showed that smaller passenger cars using diesel, had less overall CO2 emissions than their diesel or larger European counterparts (G. Mellios, 2011).

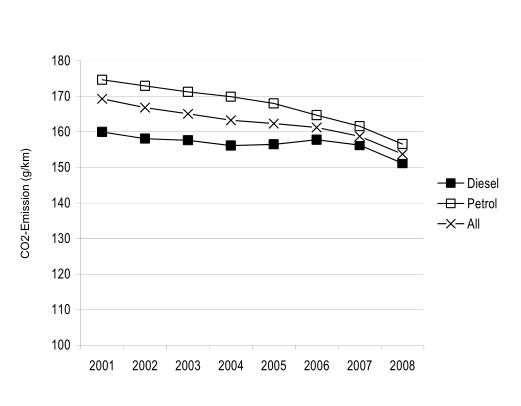


Figure European ICE emissions (G. Mellios, 2011)

Researchers have also shifted from a single-engine point car model to more aggregate systems, that consider traffic conditions or city characteristics as a whole (Kevin R. Gurney, 2012)—one such study reinforced that ICE engine CO2 emissions account for 90% of macro emissions within most cities (Toshiko, 2003). (J.A. Paravantis \*, 2006) incorporated changes in the overall automotive fleet between in Greece as a baseline for CO2 reduction. (Kii, 2020) took the societal aspect of emissions even further, by incorporating changing population dynamics and road infrastructure into CO2 emission modeling, and concluded that technology and a slower growing population, and thus less transportation, would drive emission reductions.

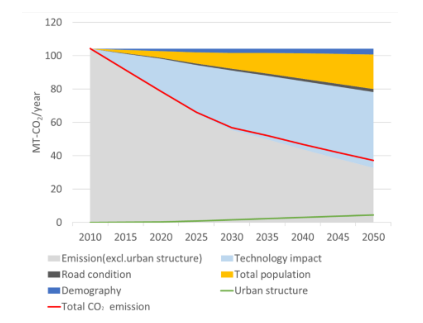


Figure : CO2 Reductions (Kii, 2020)

The authors of this paper have found that most studies are localized on a single country or continent, and therefore might not reflect the diversity of automotive manufactures, which while CO2 emission reduction is ubiquitous, ideological differences might impact individual car design. Therefore the authors wanted to focus on the California market, which as mentioned before is diverse and the largest in the US.

# Methodology

# Experimentation and Results

# Discussions and Conclusions

# References

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