Environmental Systems and Societies

Extended Essay

Topic

"Effects of different fueled cars on the environment"

Research Question

What is the effect of gasoline, diesel and hybrid cars on the environment in terms of their carbon emissions?

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<u>1.Introduction</u>: Automobiles are vital in logistics, transportation, and construction. Vehicles had a huge impact on modern society, as is well known. A motor vehicle is defined as "a self-propelled vehicle capable of conveying humans, materials, or permanently or temporarily mounted apparatus." Automobiles have evolved significantly over the years, supporting countless civilisations in their growth and development. The most recent breakthrough is the electrification of engine technology. In addition to the achievements, the public should be informed of hazardous gas releases and other environmental concerns. This extended essay focuses on CO_2 emissions, which are part of this group. CO_2, a greenhouse gas, is harmful to the environment. Climate change and global warming are examples of long-term effect. The goal of this extended essay is to compare CO_2 emissions from gasoline, diesel, and hybrid vehicles, and then make a decision based on that data. (Legal Information Institute, law.cornell.edu)

1.1 Carbon Footprint: The earth's temperature rises as the amount of gases in the atmosphere increases, including water vapour, carbon dioxide, methane, and nitrous oxide. The influence of human activity is the fundamental reason behind this. These activities can create greenhouse gas emissions either directly or indirectly. The amount of carbon dioxide equivalent emitted into the atmosphere as a result of heating, lighting, cooking, transportation, animal activities, and industrial processes is steadily increasing. Carbon footprint refers to the number of greenhouse gases(in this study CO_2 is taken as a reference) emitted by an individual, a country, or an organization as a result of their actions. (Center for Sustainable Systems, css.umich.edu) Vehicles, especially cars have a huge carbon footprint.

1.2 Carbon Emission: Carbon is commonly mentioned in talks about the environment, natural resources, and human health. CO2 and other greenhouse gases are emitted into the atmosphere when fossil fuels such as coal, natural gas, and oil are transported, processed, and used. Carbon dioxide, as well as other greenhouse gases, pose a threat to the ecosystem.

What is carbon emission? Defining briefly Scientists are now working on a carbon emission solution. Carbon emissions are defined as follows: Carbon emission is the amount of CO_2 gaseous substance discharged into the atmosphere. Carbon dioxide is emitted into the atmosphere naturally; In the ocean-atmosphere carbon dioxide exchange, Humans, animals, and plants all breathe out carbon dioxide. Carbon dioxide is released back into the atmosphere when dead animals and plants are mixed with soil. They are all-natural carbon emissions that help maintain a natural balance. The "damaging" element of the task is the human contact part. Fossil fuels such as coal, natural gas, and oil pose a "risk" to the environment by releasing unwelcome carbon dioxide and other greenhouse gases into the atmosphere. Human-driven cars are one of the main threats.

1.3 Fossil Fuels: There are many different types of fossil fuels, but gasoline and diesel will be the focus of this essay.

1.3.1 Gasoline: Petrol is a highly combustible secondary fuel that can be thought of as a type of cash. It feeds a large number of heat engines and, more critically, a large number of automobiles. Fractional distillation is the process by which crude oil is converted into petroleum products such as gasoline. The completed product is transported to gas stations via pipelines. The majority of internal combustion engines are gas-powered. Gasoline is one of the most frequently used petroleum products as a result. Gasoline accounts for approximately half of all petroleum products. Automobiles powered by gasoline emit a significant amount of CO2 into the atmosphere. (Energy Education, energyeducation.ca)

1.3.2 Diesel: Diesel is the most common transportation fuel. Because diesel has a higher mass density than gasoline, it contains more energy in a given volume. Additionally, diesel engines allow for larger compression ratios. Diesel engines are more energy efficient than gasoline engines due to their higher mass density and compression ratios. Unlike gasoline engines, diesel engines ignite the fuel through compression rather than spark plugs. A diesel piston heats the air by pressurizing it. Fuel injectors atomize and convert the fuel to a gas. The heat generated in the chamber increases the temperature of the diesel gas, which ignites. Diesel comes in two varieties: petroleum and biodiesel. Petrodiesel is diesel produced from petroleum. Diesel is normally refined to remove sulfur. Now more popular than biodiesel, it is increasingly used in trucks, buses, and heavy vehicles. Petrodiesel is made by boiling crude oil and separating its constituents. Diesel has a greater boiling point than gasoline, which enables it to separate more quickly from crude oil. This process can be used to separate diesel, kerosene, and gasoline. Biodiesel is a type of diesel fuel derived from biomass, such as algae. It emits less carbon dioxide than petrodiesel does because it absorbs carbon dioxide from the atmosphere as it grows, whereas petrodiesel emits carbon that has been buried in the earth for millions of years. Pure biodiesel, B100, is a fuel that is used infrequently in transportation. But petrodiesel is used instead. Pure biodiesel tends to clump in the cold, so B20 is the best combination. (Energy Education, energyeducation.ca) (B20 is set as a base reference in this study). Both products and usage of these products (petrodiesel and biodiesel) in cars release a considerable amount of CO_2 into the atmosphere.

1.3.3 Hybrid Principle: Simply put, a hybrid vehicle is propelled forward by a combination of at least one electric motor and a gasoline or diesel engine, with energy recovered by regenerative braking. At times, the electric motor performs all of the work, while the ICE (Internal Combustion Engine) performs all of the work at other times. As a result, the vehicle consumes less fuel, resulting in increased fuel economy. Adding electric power can sometimes even increase performance. (What are hybrid vehicles? www.dummies.com) Each of them utilizes a high-voltage battery pack that is recharged by absorbing energy during deceleration that would otherwise be wasted owing to the heat generated by the brakes in conventional automobiles. In hybrid vehicles, the gas engine is also used to charge and maintain the battery. Automobile manufacturers employ a variety of hybrid designs to meet a variety of objectives, ranging from maximum fuel efficiency to maintaining the lowest possible vehicle costs. (Alternative Fuels Data Center, afdc.energy.gov) Hybrid vehicles emit CO2 into the atmosphere due to the additional gasoline or diesel fuel they consume.

1.4 Effects of Fossil-Fuels on the Environment: For almost a century, fossil fuels have supplied the majority of the energy required to power our autos, operate our businesses, and keep our homes lit. Today, oil, coal, and gas still contribute around 80% of our energy demands. And as a result, the ecosystem suffers. From air and water pollution to global warming, mankind and the environment have paid a high price for utilizing fossil fuels for energy. Additionally, there are negative repercussions associated with petroleum-based products such as gasoline and diesel. Here is an explanation of what fossil fuels are, how much they cost humanity, and why the time has come to transition to sustainable energy.

1.4.1 Soil-Land Degradation: Underground exploration, processing, and transportation of oil, gas, and coal harm our landscapes and ecosystems. Massive swaths of land are leased by the fossil fuel sector for wells, pipelines, access roads, processing, waste storage, and disposal. Strip mining entails the destruction of enormous swaths of land, including forests and mountaintops, in order to get access to subsurface coal or oil reserves. It is improbable that the land that has been nutrient leached will ever be the same. As a result, vital breeding and migration sites for species are eliminated. Even animals that have the ability to run suffer because they are forced into unsuitable habitats and forced to compete for resources with established fauna. (Green, J., sciencing.com)

1.4.2 Water Pollution: Our streams and groundwater are threatened by coal, oil, and gas development. Coal mining discharges acidic runoff into streams, rivers, and lakes, as well as a variety of undesirable rock and soil. Accidental spills or leaks of crude oil during extraction or transportation can contaminate drinking water and endanger entire freshwater or ocean ecosystems. The Environmental Protection Agency (EPA) was first hesitant to acknowledge that fracking and its harmful chemicals polluted drinking water. And each of these operations produces enormous amounts of wastewater including heavy metals, radioactive elements, and other contaminants. Their storage in open pits or underground wells can result in leakage into streams, poisoning aquifers with substances known to cause cancer, birth deformities, and neurological impairments. (Can cars cause water pollution, cms2files.revize.com)

1.4.3 Global Warming: When fossil fuels are used, they contribute not only to our energy needs, but also to the current global warming calamity. When fossil fuels are burned, a significant amount of carbon dioxide is released. Carbon emissions contribute to climate change by trapping heat in the atmosphere. (Martin, M. J. homeguides.sfgate.com)

1.4.4 Ocean Acidification: The burning of fossil fuels changes the ocean's chemistry, making it acidic. The world's oceans absorb up to a quarter of all human carbon emissions. A study found that the ocean has become 30% acidic since the Industrial Revolution. The amount of calcium carbonate—used by oysters, lobsters, and other marine animals to build shells—decreases as ocean acidity rises. Whole food chains may be put at risk as a result of slowed growth rates and weakened shells. Ocean acidification affects coastal communities. The oyster industry in the Pacific Northwest has reportedly lost millions of dollars and thousands of jobs. (Gazioğlu, C et al., dergipark.org.tr)

2. Aim of the Research: Its goal is to investigate and compare the carbon emissions of gasoline, diesel, and hybrid principled vehicles using statistical approaches. It is set as a goal to develop assumptions about the carbon footprints of cars that work as indicated in the previous line as a result of the inquiry that will be undertaken.

This will allow vehicle types that emit less CO_2 to be identified, and a proposal to extend the use of vehicles that utilize this fuel to be made.

3. Method of Investigation

3.1 Risks of Using Secondary Data: To understand the risks of using secondary data in research, first define secondary data. Secondary data is information gathered for another purpose but relevant to your current research. Someone else has already gathered it, not you. You can now use the data. Secondary data is second-hand information. It's not the first time. That's why it's secondary. Secondary data can be found on the internet, libraries, and reports. In addition to websites, secondary data sources include reports, encyclopedias, and government statistics. The reader knows what secondary data is. It's time to talk about the risks of using secondary data in research. For this discussion, the benefits and drawbacks will be listed and explained.

3.1.1 Pros of Using Secondary Data:

- **Ease of access:** Secondary data are simple to use. The Internet and other scientific sources have altered the way research is undertaken.
- **Low costs:** Numerous secondary sources are either free or extremely inexpensive to use. It enables you to save money and time.
- **Time spent:** Secondary research can be accomplished in a short period of time. Occasionally, locating a data source is quite straightforward.

3.1.2 Cons of Using Secondary Data:

- **Lack of control over the research:** There's a good chance the information you find online isn't accurate. You can't change the data, so you don't have control over your own research.
- **Biasness:** Due to human nature, secondary data collected by someone other than you is likely to be biased in favor of the person who gathered it.
- **Time period:** Because secondary data was collected in the past, it has limitations of its own, making it in some cases unsuitable for today's standards.

3.2 Ethical Considerations of Using Secondary Data: The ethical use of secondary data is critical in the research process because secondary data, like primary data, forms the study's core. The ethics of using secondary data is straightforward, but it is sometimes overlooked. Plagiarism is a major ethical concern for many people, including this essay's author. The data used must be open source or closed source, and its creators must have made it anonymous. In order to avoid plagiarism, properly cite datasets rather than copying someone else's work. The second major issue is the data's accuracy and reliability. It is prudent to use reputable sources who have a proven track record of working ethically.

During this investigation, data sources for the secondary data which is open source are selected carefully in order to get proper results. Reliability of selected sources are trusted because the data has been pulled from government data pools. (*Open Government*, www.nationalarchives.gov.uk) (*Car CO2 and fuel economy figures,* www.fleetnews.co.uk)

3.3 Data and Analysis

The analysis used three data sets synthesized from the raw data sheet. For this study selected engine volumes are 1.5 for gasoline and diesel, but for the hybrids, selected engine volume is 1.6 because of the reason that there is not enough data for statistical analysis with 1.5 engine volume. Manufacturers of the selected vehicles for hybrid cars are different for the same reason.

3.3.1 Collected secondary data and comparisons: The analysis used three data sets synthesized from the raw datasheet. The raw data sheets are in the essay's appendix. This means that the total data used for each ICE category is worth 50 sets for each CO2 figure in the selected/ gathered data tables. (you can see the appendix for whole data pool)

Maximum CO2 figures for each car model is used in the statistical analysis.

GASOLINE FUELED					
Manufacturer	Model	Engine-Volume	Powertrain	Fuel Type	CO2 Figures
Audi	A3	1.5	ICE	Gasoline	146
BMW	2 Series	1.5	ICE	Gasoline	144
Citroen	C5 Aircross	1.5	ICE	Gasoline	127
Ford	Focus 2020	1.5	ICE	Gasoline	142
Honda	Civic 2020	1.5	ICE	Gasoline	144
Seat	Arona	1.5	ICE	Gasoline	132
Skoda	Octavia	1.5	ICE	Gasoline	124
Hyundai	Tuscon	1.5	ICE	Gasoline	179
Renault	Megane	1.5	ICE	Gasoline	175
Peugeot	508	1.5	ICE	Gasoline	156

Table1: Gasoline fueled cars - manufacturer, model, engine volume, powertrain and average CO_2 figures

DIESEL FUELED					
Manufacturer	Model	Engine-Volume	Powertrain	Fuel Type	CO2 Figures
Audi	A3	1.5	ICE	Diesel	129
BMW	2 Series	1.5	ICE	Diesel	141
Citroen	C5 Aircross	1.5	ICE	Diesel	156
Ford	Puma 2020	1.5	ICE	Diesel	110
Honda	Jazz 2020	1.5	ICE	Diesel	118
Seat	Ibiza 2020	1.5	ICE	Diesel	130
Skoda	Scala	1.5	ICE	Diesel	95
Hyundai	i30	1.5	ICE	Diesel	137
Renault	Megane	1.5	ICE	Diesel	132
Peugeot	308	1.5	ICE	Diesel	127

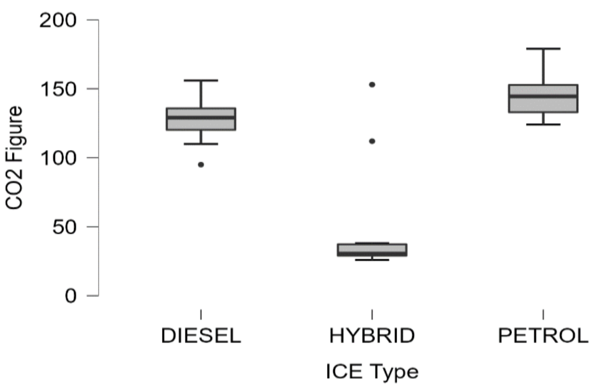
Table2: Diesel fueled cars - manufacturer, model, engine volume, powertrain and average CO_2 figures

HYBRIDS					
Manufacturer	Model	Engine-Volume	Powertrain	Fuel Type	CO2 Figures
Audi	A3	1.6	PHEV	E/ P	43
Hyundai	Kona	1.6	HEV	E/ P	35
Citroen	C5 Aircross	1.6	PHEV	E/ P	29
Ford	Focus 2020	1.6	HEV	E/ P	112
Hyundai	Santa Fe	1.6	HEV	E/ P	37
Seat	Leon	1.6	PHEV	E/ P	26
Renault	Megane	1.6	PHEV	E/ P	30
Hyundai	Tuscon	1.6	PHEV	E/ P	31
Peugeot	3008	1.6	PHEV	E/ P	32
Peugeot	508	1.6	PHEV	E/ P	29

Table3: Hybrid cars - manufacturer, model, engine volume, powertrain and average CO_2 figures

Descriptives - CO2		
ICE type	Mean	SD
Gasoline	146.300	18.726
Diesel	127.500	16.966
Hybrid	51.100	44.112

Table4: Mean and Standard deviation of the datasets.



Graph1: The mean CO_2 release of different fueled cars.

3.3.2 Statistical analysis: The ANOVA method was used as a statistical study to see if there was a significant difference in the amount of CO2 emitted by automobiles using various fuels.

Disclaimer: All statistical analysis is done through JASP 0.16.0.0. The fuel type gasoline is called petrol during the statistical analysis to minimize the spaces that tables take.

Even if a difference can be seen between the three sets, It was decided to test these three sets using the ANOVA method to see if there is really a distinctive difference between all the datasets.

ANOVA - CO2 figures						
Homogeneity corrections	Cases	Sum of Squares	df	Mean Square	F	p
None	ICE Type	50844.800	2.000	25422.400	29.511	< .001
— — — — — — — —	Residuals	23259.500	27.000	861.463		
Welch	ICE Type	50844.800	2.000	25422.400	19.124	< .001
— — — — — — — —	Residuals	23259.500	16.696	1393.124		

Note. Type III Sum of Squares

Table5: Results of ANOVA with and without homogeneity corrections.

A homogeneity test was needed and used to determine if the samples of the data is distributed equally around the mean of the data sets. But because the homogeneity test was conducted without any homogeneity corrections. This did not show the wanted p-value which should be higher than < .01 to be valid as there is a difference between variances, It was needed to use a homogeneity correction method to check if the first calculation without a method is correct. As it can be seen in the table above using the Welch correction method it was solidified that the first calculation was valid.

According to the ANOVA results, the amount of CO_2 released by automobiles using different fuels differs significantly. Post-hoc analyses were conducted to ascertain whether the CO_2 amounts released by these cars differed significantly.

Post hoc means "after this" and refers to analyzing the results of your experiments. They commonly make use of the familywise error rate, or the probability that at least one Type I error will occur in a collection of comparisons. Two Post Hoc tests were run during the statistical analysis. A Bonferroni correction and Tukey's test. Let's start with the Bonferroni adjustment to understand these tests. Use this post hoc adjustment when running multiple independent or dependent statistical tests. Running multiple tests at the same time increases the likelihood of a significant result. The Tukey's test. The significance cutoff is /n. If 20 tests are run at 0.05, the correction is 0.0025. There is a lot to learn. Its power has been reduced. This is due to high Type II error rates in each test. In other words, it overcorrects Type I errors. Tukey's test is used to compare groups in a sample. The "Honest Significant Difference," a statistic that shows the distance between groups, is used to compare each mean.

Post Hoc Comparisons - ICE Type					
	Mean Difference	SE	t	pTUKEY	pBONFERRONI
Diesel - Hybrid	76.400	13.126	5.820	< .001	< .001
Petrol	-18.800	13.126	-1.432	0.339	0.491
Hybrid - Petrol	-95.200	13.126	-7.253	< .001	< .001

Note. P-value adjusted for comparing a group of three

table6: Table of Post Hoc Comparisons between ICE types

To make a comment on the significance of the post hoc comparison, you must first grasp how to use the p-value as a baseline. In summary, as the p-value falls below 0.05, the difference between the fuel types increases more and larger, as shown in the table above. With this knowledge, it is possible to conclude that petrol-hybrid and diesel-hybrid couples differ significantly. In the table above, the hybrid is used as a middle foundation once again.

4. Conclusion

The goal of this study was to compare CO_2 numbers from fossil-fueled ICEs to hybrid ICEs to establish a carbon footprint estimate and the start of all these was the research question "What is the effect of gasoline, diesel and hybrid cars on the environment in terms of their carbon emissions?". My assumptions had to be backed up by data, in this case, statistics. As a result, the data was divided into three categories: gasoline-fueled, diesel-fueled, and hybrid. Despite this, the total data acquired was pages long. As a result, the data was reduced in size to make it easier to work with. These datasets had to meet three criteria: a specific engine volume, ten popular European brands, and most importantly, existing data on them. After reducing all data to three tables (Table 1, Table 2, and Table 3), it was time to tackle the statistical part of the arithmetic. A program was required to begin statistics. The first thought was to use SPSS. But I had an issue: my SPSS license had expired. To avoid spending money, a new program was needed. As a result, other options were investigated. After thorough research, I discovered JASP 0.16.0.0, a free tool that saved me money and helped me do statistics thanks to its user-friendly interface.

After running the program on the three datasets, the ANOVA technique was used to see if there was a significant difference between them. Throughout the investigation, the results were compared to the initial hypothesis. The data quickly dispelled this notion.

It's also vital to talk about the potential for errors induced by using a reduced data intake. The lack of homogeneity within the datasets utilized causes the error bars on Graph 1.

As a consequence of the tests performed on the three datasets, it was evident that there was a significant difference in the CO_2 figures of the three types of differently fueled cars that were worked. Hybrid ICEs have the lowest overall CO_2 figures and the largest disparity in overall CO_2 figures among the three types of ICEs, according to the results of the study. As a result, cars with hybrid ICEs have a lower carbon footprint.

Carbon Footprint of Hybrid and Fossil Fueled Cars: The study has helped the reader understand the carbon footprints of hybrid and conventional vehicles. When comparing the CO_2 figures between gasoline, diesel, and hybrid vehicles, significant differences were found when using the ANOVA method to analyze the statistical data. While there is a big difference between gasoline and diesel, hybrid gasoline and diesel couples show even more. The hybrid-gasoline couple was the most distinct. Thus, the ICE group with the lowest CO_2 footprint is easily deduced to be hybrids. In light of this, and the fact that the greenhouse effect is raising global temperatures, hybrid vehicles are expected to gain popularity in Central European markets and on roads. Experts estimate that if left to their own devices, states will take ten to fifteen years to transition to hybrid vehicles. CO_2 emissions from aging fossil fuel vehicles could result in significant air pollution. Due to government incentives, hybrid vehicles will be available sooner, reducing the impact on air pollution and lowering the carbon footprint of the vehicles in less than a decade, if not less. It can help the continent's future.

To conclude all of this research and statistical analysis, a brief summary of the essay's events and accomplishments is required. You may recall that the purpose of this article was to compare the CO_2 emissions of hybrid vehicles to those of gasoline and diesel vehicles in order to assess their carbon footprints and thus their future. As a result of this rationale, I set out to do a variance analysis with data collection, followed by an ANOVA. As stated previously, the analysis of variance is used to support scientific assumptions and evaluations. Based on all of this statistical analysis, the carbon emission differential between the three sets of ICE types chosen is consistent with the initial premise. Based on the findings, predictions have been made about the future of hybrid vehicles. However, this study could be improved. This improvement includes using one-to-one measurements rather than secondary data and using more samples rather than the 50 used for each type of ICE. Writing this essay taught me a lot of new things, the most important of which is how to access reliable data.

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6. Appendix:

Manufacturer	Model	Engine Volume	Powertrain	Fuel Type	CO2 figures
AUDI	A3	1.4	PHEV	E/ P	38-38
AUDI	A6	2.0	HEV	E/ P	145-145
AUDI	A7	3.0	HEV	E/ D	148-152
AUDI	Q7	3.0	PHEV	E/ D	48-48
BMW	3 Series	2.0	PHEV	E/ D	32-37
BMW	5Series	3.0	PHEV	E/ D	39-41
BMW	7 Series	3.0	PHEV	E/D	47-52
BMW	X3	2.0	PHEV	E/ P	45-47
CITROEN	C5 Aircross	1.6	PHEV	E/P	29-29
FORD	Fiesta 2020	1.0	HEV	E/ D	112-112
FORD	Focus 2020	1.0	HEV	E/ P	112-112
FORD	Puma 2020	1.0	HEV	E/ D	126-126
HONDA	NSX	3.5	HEV	E/P	242-242
HYUNDAI	IONIQ	1.6	HEV	E/ P	103-103
HYUNDAI	Kona	1.6	HEV	E/ P	114-122
HYUNDAI	Santa Fe	1.6	PHEV	E/ P	37-37
HYUNDAI	Tucson	1.6	PHEV	E/ P	31-31
MERCEDES-BENZ	A250	1.4	PHEV	E/ P	22-22
MERCEDES-BENZ	E300	2.0	PHEV	E/ D	34-36
MERCEDES-BENZ	GLC300e	2.0	PHEV	E/ P	60-65
MERCEDES-BENZ	GLE350	1.5	PHEV	E/ D	19-19
PEUGEOT	508	1.6	PHEV	E/ D	29-29
PEUGEOT	3008	1.6	PHEV	E/ D	28-36
RENAULT	Captur	1.6	PHEV	E/ P	34-34
RENAULT	Megane	1.6	PHEV	E/ P	30-30
RENAULT	Clio	1.6	HEV	E/ P	96-105
SEAT	Leon	1.4	PHEV	E/ P	26-26
SEAT	Tarraco	1.4	PHEV	E/ P	42-42
SKODA	OCTAVIA	1.4	PHEV	E/ P	27-28
SKODA	SUPERB	1.4	PHEV	E/ P	27-28
TOYOTA	Corolla	1.8	HEV	E/ P	101-104
TOYOTA	Prius	1.8	PHEV	E/ P	29-29
TOYOTA	Yaris	1.5	HEV	E/ P	110-115
TOYOTA	Camry	2.5	HEV	E/ P	115-125
TOYOTA	RAV4	2.5	HEV	E/ P	126-134

Table4: Data pool for Hybrid principle cars

Manufacturer	Model	Engine Volume	Powertrain	Fuel Type	CO2 figures
AUDI	A1	1.0	ICE	Gasoline	126-132
AUDI	A3	1.0	ICE	Gasoline	125-131
AUDI	A3	1.5	ICE	Gasoline	144-149
AUDI	A4	2.0	ICE	Gasoline	153-158
AUDI	A4 Quattro	2.0	ICE	Gasoline	164-170
BMW	1 Series	1.5	ICE	Gasoline	141-146
BMW	2 Series	1.5	ICE	Gasoline	141-147
BMW	2 Series	2.0	ICE	Gasoline	151-162
BMW	3 Series	2.0	ICE	Gasoline	145-151
BMW	4 Series	3.0	ICE	Gasoline	194-198
CITROEN	C1	1.0	ICE	Gasoline	109-117
CITROEN	C3 Aircross	1.2	ICE	Gasoline	110-110
CITROEN	C5 Aircross	1.5	ICE	Gasoline	125-130
CITROEN	C5 Aircross	1.6	ICE	Gasoline	155-162
FORD	Fiesta 2020	1.0	ICE	Gasoline	114-142
FORD	Fiesta 2020	1.5	ICE	Gasoline	138-153
FORD	EcoSport 2020	1.0	ICE	Gasoline	134-151
FORD	Focus 2020	1.0	ICE	Gasoline	119-154
FORD	Focus 2020	1.5	ICE	Gasoline	126-158
FORD	Focus 2020	2.3	ICE	Gasoline	174-190
FORD	Puma 2020	1.0	ICE	Gasoline	130-154
FORD	Puma 2020	1.5	ICE	Gasoline	153-158
FORD	Mondeo 2020	2.0	ICE	Gasoline	129-138
HONDA	Civic 2020	1.0	ICE	Gasoline	137-150
HONDA	Civic 2020	1.5	ICE	Gasoline	137-151
HONDA	Civic 2020	2.0	ICE	Gasoline	193-194
HONDA	CR-V 2020	1.5	ICE	Gasoline	181-204
HONDA	CR-V 2020	2.0	ICE	Gasoline	168-171
HONDA	HR-V 2020	1.5	ICE	Gasoline	151-164
HONDA	Jazz 2020	1.3	ICE	Gasoline	135-139
HYUNDAI	i10	1.2	ICE	Gasoline	128-131
HYUNDAI	i20	1.0	ICE	Gasoline	134-136
HYUNDAI	İ30	1.4	ICE	Gasoline	140-142
HYUNDAI	i30	2.0	ICE	Gasoline	180-188
HYUNDAI	Kona	1.6	ICE	Gasoline	186-190
HYUNDAI	Tucson	1.6	ICE	Gasoline	178-180
MERCEDES-BENZ	A180	1.4	ICE	Gasoline	134-152
MERCEDES-BENZ	AMG GT	4.0	ICE	Gasoline	273-278
MERCEDES-BENZ	CLA200	1.4	ICE	Gasoline	134-153
MERCEDES-BENZ	C200	1.5	ICE	Gasoline	148-155
MERCEDES-BENZ	E200	2.0	ICE	Gasoline	160-193
PEUGEOT	308	1.2	ICE	Gasoline	120-128
PEUGEOT	308	1.6	ICE	Gasoline	169-169
PEUGEOT	2008	1.2	ICE	Gasoline	125-126

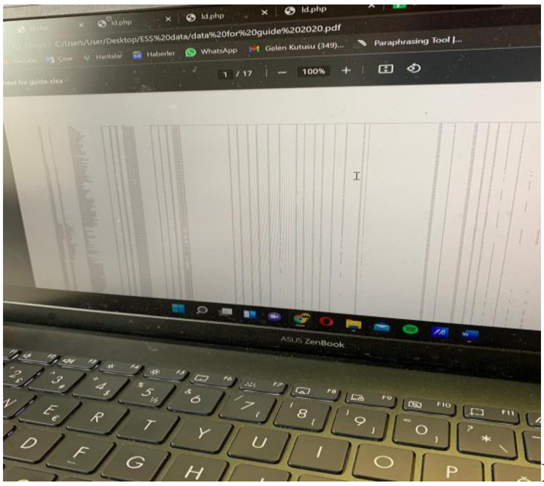
PEUGEOT	3008	1.6	ICE	Gasoline	165-165
PEUGEOT	508	1.6	ICE	Gasoline	154-157
RENAULT	Clio	1.0	ICE	Gasoline	117-118
RENAULT	Megane	1.3	ICE	Gasoline	137-150
RENAULT	Megane	1.8	ICE	Gasoline	170-190
RENAULT	Kadjar	1.3	ICE	Gasoline	149-150
SEAT	Ibiza	1.0	ICE	Gasoline	120-126
SEAT	Arona	1.5	ICE	Gasoline	130-134
SEAT	Leon CUPRA	2.0	ICE	Gasoline	171-179
SEAT	Ateca	2.0	ICE	Gasoline	190-197
SEAT	Tarraco FR	2.0	ICE	Gasoline	199-214
SKODA	FABIA	1.0	ICE	Gasoline	120-124
SKODA	OCTAVIA	1.5	ICE	Gasoline	122-126
SKODA	KAMIQ	1.5	ICE	Gasoline	135-150
SKODA	KAROQ	1.5	ICE	Gasoline	156-163
SKODA	KODIAQ	2.0	ICE	Gasoline	197-213
TOYOTA	AYGO	1.0	ICE	Gasoline	113-115
TOYOTA	Yaris	1.0	ICE	Gasoline	129-134
TOYOTA	Yaris	1.5	ICE	Gasoline	141-145
TOYOTA	Supra	3.0	ICE	Gasoline	180-190
TOYOTA	GT86 Boxer	2.0	ICE	Gasoline	190-200

Table5: Data pool for gasoline fueled cars

Manufacturer	Model	Engine Volume	Powertrain	Fuel Type	CO2 figures
AUDI	A3	1.6	ICE	Diesel	135-139
AUDI	A3	2.0	ICE	Diesel	136-140
AUDI	A4	2.0	ICE	Diesel	132-136
AUDI	A5	2.0	ICE	Diesel	130-134
AUDI	A4 Quattro	2.0	ICE	Diesel	165-170
BMW	1 Series	1.5	ICE	Diesel	117-120
BMW	2 Series	1.5	ICE	Diesel	124-134
BMW	2 Series	2.0	ICE	Diesel	134-145
BMW	3 Series	2.0	ICE	Diesel	134-138
BMW	X2	2.0	ICE	Diesel	145-150
CITROEN	C1	1.0	ICE	Diesel	109-109
CITROEN	C3 Aircross	1.2	ICE	Diesel	110-132
CITROEN	C5 Aircross	1.5	ICE	Diesel	129-154
CITROEN	C5 Aircross	1.6	ICE	Diesel	157-178
FORD	Fiesta 2020	1.0	ICE	Diesel	118-121
FORD	Focus 2020	1.5	ICE	Diesel	106-139
FORD	Focus 2020	2.0	ICE	Diesel	119-142
FORD	Puma 2020	1.0	ICE	Diesel	130-130
FORD	Puma 2020	1.5	ICE	Diesel	153-159
FORD	Mondeo 2020	2.0	ICE	Diesel	130-176
HONDA	Civic 2020	1.6	ICE	Diesel	122-123

HONDA	HR-V 2020	1.6	ICE	Diesel	135-137
HONDA	Jazz 2020	1.3	ICE	Diesel	133-139
HONDA	Jazz 2020	1.5	ICE	Diesel	110-110
HYUNDAI	i20	1.1	ICE	Diesel	84-87
HYUNDAI	i20	1.4	ICE	Diesel	91-96
HYUNDAI	İ30	1.6	ICE	Diesel	94-96
HYUNDAI	Tucson	2.0	ICE	Diesel	145-151
MERCEDES-BENZ	A180	1.5	ICE	Diesel	117-124
MERCEDES-BENZ	B180	1.5	ICE	Diesel	122-127
MERCEDES-BENZ	C220	2.0	ICE	Diesel	130-135
MERCEDES-BENZ	CLA220	2.0	ICE	Diesel	126-131
MERCEDES-BENZ	S350	3.0	ICE	Diesel	170-186
PEUGEOT	208	1.5	ICE	Diesel	107-112
PEUGEOT	308	1.5	ICE	Diesel	125-129
PEUGEOT	508	2.0	ICE	Diesel	145-149
PEUGEOT	3008	1.5	ICE	Diesel	125-136
PEUGEOT	5008	2.0	ICE	Diesel	150-156
RENAULT	Captur	1.5	ICE	Diesel	124-125
RENAULT	Clio	1.5	ICE	Diesel	109-110
RENAULT	Kadjar	1.7	ICE	Diesel	142-155
RENAULT	Megane	1.5	ICE	Diesel	130-134
SEAT	Ibiza	1.6	ICE	Diesel	121-128
SEAT	Leon	1.6	ICE	Diesel	125-130
SEAT	Leon	2.0	ICE	Diesel	135-150
SEAT	Ateca	2.0	ICE	Diesel	148-157
SKODA	SCALA	1.6	ICE	Diesel	123-136
SKODA	SUPERB	2.0	ICE	Diesel	132-150
SKODA	OCTAVIA	2.0	ICE	Diesel	131-134
SKODA	KODIAQ	2.0	ICE	Diesel	170-190
SKODA	KAROQ	2.0	ICE	Diesel	174-185
TOYOTA	Land Cruiser	2.8	ICE	Diesel	134-145

Table5: Data pool for diesel fueled cars



Picture1: My screen while searching through the data pool