

# Analysis on Energy Consumption

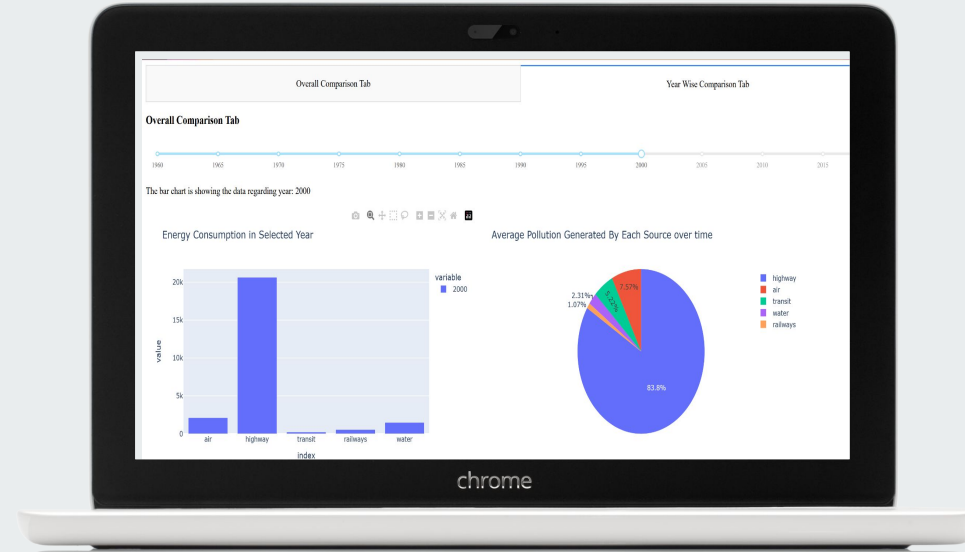
## Mode of Transportations

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# Introduction



- Over time, one of the most significant aspects of life that has been put in danger by the current way of life of travel is the pollution that is being produced. They are damaging the environment, and in certain parts of the world, the pollution is turning certain cities inadequate.
- In this project we have analyzed the amount of energy consumption by various modes of transportation. This is vary depending on the size of population, country. We have considered data related to the United States for this project.



- We chosen the dataset from the U.S. Census data and statistics from The Bureau of Transportation Statistics (BTS) that offers categorical data on Energy Consumption by Mode of Transportation.
- By analyzing this data, we hope to determine whether we are considering the optimal modes of transportation.

# User Stories and Overview

## **General person**

- A person who travels by different mode of transport wants to know about the energy resource consumption and CO2 emissions and wants to know which mode of transportation is the most economical.

## **Socioeconomic**

- An individual who is concerned about society wants to know how much energy been consumed by transportation industry and wants to conduct a self-analysis to determine how much pollution future generations will face.

## **Research**

- The pollution department intends to collect student-documented analysis reports on energy waste from universities.
- The U.S. Department of Energy is concerned with the amount of energy that is turning into pollution in order to reduce the amount used and improve the air quality in U.S. cities.

# Dataset

We chosen the dataset “Energy Consumption by Mode of Transportation”.

1	Table 4-6M: Energy Consumption by	Transportation (petajoules)																						
2		1970	1975	1980	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
3	Air																							
4	Certificated carriers <sup>a</sup>																							
5	Jet fuel	1,119	1,077	1,213	1,441	1,739	1,618	1,652	1,703	1,780	1,825	1,878	1,945	1,895	2,064	1,980	1,868	1,750	1,769	1,906	1,892	1,854	1,851	1,77
6	General aviation <sup>b</sup>																							
7	Aviation gasoline	70	52	66	53	45	45	40	34	34	36	37	37	39	44	42	35	35	35	35	37	36	35	3
8	Jet fuel	30	65	109	98	94	82	70	65	66	80	87	91	116	138	138	131	134	133	175	217	234	212	24
9	Highway																							
10	Gasoline, diesel and other fuels																							
11	Light duty vehicle, short wheel base and motorcycle <sup>c</sup>	8,614	9,423	8,907	9,099	8,853	8,186	8,329	8,534	8,594	8,664	8,769	8,896	9,125	9,312	9,299	9,360	9,602	9,600	9,595	9,849	9,547	11,743	10,92
12	Light duty vehicle, long wheel base <sup>c</sup>	1,563	2,421	3,020	4,222	4,519	4,850	5,194	5,438	5,638	5,788	5,982	6,268	6,404	6,697	6,718	6,792	7,008	7,711	8,048	7,471	7,701	4,360	4,43
13	Single-unit 2-axle 6-tire or more truck <sup>d</sup>	504	688	879	939	1,037	1,045	1,077	1,146	1,147	1,170	1,188	1,215	865	904	1,214	1,227	1,310	1,127	1,137	1,206	1,250	2,073	2,17
14	Combination truck	933	1,165	1,655	1,777	2,047	2,133	2,185	2,252	2,370	2,510	2,551	2,576	3,193	3,330	3,257	3,238	3,360	3,022	3,070	3,514	3,567	3,928	3,87
15	Bus	104	134	129	106	114	110	111	118	124	123	125	130	132	145	141	130	127	123	173	142	146	257	26
16	Transit <sup>e</sup>																							
17	Electricity	9	10	9	15	17	17	17	18	18	18	18	18	18	18	19	20	20	20	20	21	21	22	2
18	Motor fuel																							
19	Diesel <sup>f</sup>	39	53	62	88	94	96	99	98	98	98	78	78	81	83	86	86	98	80	79	77	79	78	9
20	Gasoline and other nondiesel fuels <sup>g</sup>	9	1	1	6	4	4	5	6	8	8	3	3	3	3	3	3	4	3	4	4	4	4	4
21	Compressed natural gas	N	N	N	N	N	N	0	0	1	2	2	3	4	5	6	8	10	12	13	14	16	16	1
22	Rail, Class I (in freight service)																							
23	Distillate / diesel fuel	514	530	566	451	452	421	436	448	483	504	510	518	510	538	536	538	541	555	588	504	608	580	56

# Dataset

- The dataset contains total of 30 rows and 38 columns. A total of 2261 null values.

```
[142] 1 for row in df['Table 4-6M: Energy Consumption by Mode of Transportation (petajoules)']:
      2 |     print(row)
```

```
Air
Certificated carriersa
Jet fuel
General aviationb
Aviation gasoline
Jet fuel
Highway
Gasoline, diesel and other fuels
Light duty vehicle, short wheel base and motorcyclec
Light duty vehicle, long wheel basec
Single-unit 2-axle 6-tire or more truckd
Combination truck
Bus
Transite
Electricity
Motor fuel
Dieself
Gasoline and other nondiesel fuelsg
Compressed natural gas
Rail, Class I (in freight service)
Distillate / diesel fuel
Amtrak
Electricity
Distillate / diesel fuel
Water
Residual fuel oil
Distillate / diesel fuel oil
Gasoline
Pipeline
Natural gas
```

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[illegible]

# Methodology

- Data Cleaning: We have renamed the column names. We have replaced the NA values by 0. Removed string data converted into numeric data. Created a index having mode of transportation's.

	1960	1965	1970	1975	1980	1985	1990	1991	1992	1993	...	2011	2012	2013	
Mode															
Jet fuel	278.313183	553.920148	1119.092468	1076.505138	1213.416014	1440.706164	1739.391642	1618.035275	1651.908512	1703.490493	...	1542.302274	1458.224346	1446.559121	14
Aviation gasoline	30.689887	37.030772	69.876560	52.248898	65.945211	53.390257	44.766653	44.893471	39.820762	33.987147	...	27.387644	26.181259	25.016502	
Jet fuel	0.000000	7.976222	29.625968	64.521941	109.103326	98.420885	94.432774	82.183576	70.361675	64.664373	...	207.431125	204.375889	179.413441	2
Light duty vehicle, short wheel base and motorcyclec	5224.936049	6310.268774	8614.429729	9423.290498	8907.141622	9099.309627	8853.059125	8185.741306	8328.606327	8534.024458	...	11267.571898	11306.444048	11304.842580	113
Light duty vehicle, long wheel basec	0.000000	0.000000	1562.679437	2421.499199	3019.938328	4222.343517	4519.341934	4850.048092	5194.289395	5438.180150	...	4484.261547	4456.306896	4461.934617	47



# Methodology

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- Data Extraction: We have chosen rows with are related to five main mode of transportations and combined accordingly. .

	air	highway	transit	railways	water
1960	278.313183	5329.889336	30.148483	501.943247	738.215962
1965	561.896371	9023.698307	35.946268	520.641104	582.985441
1970	1148.718436	11717.337229	115.171246	513.828707	790.633669
1975	1141.027079	13831.034365	145.547957	539.208511	892.993490
1980	1322.519339	14589.376687	195.978822	575.067812	1761.536940
1985	1539.127049	16143.884595	221.867899	460.170205	1104.800114
1990	1833.824416	16570.544138	259.344284	463.402470	1463.393063
1991	1700.218851	16323.926192	313.424526	433.094549	1583.275679
1992	1722.270186	16896.443140	266.459699	447.371595	1525.144021
1993	1768.154866	17488.717609	209.455851	459.590427	1257.371207

Displaying top 10 results

# Methodology

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- With these data we gonna start implementation.

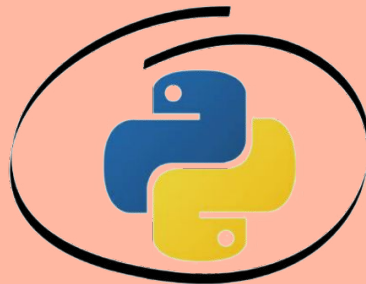
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Displaying top 10 results

# Tools and Frameworks



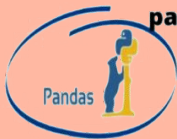
plotly | Dash



numpy



seaborn

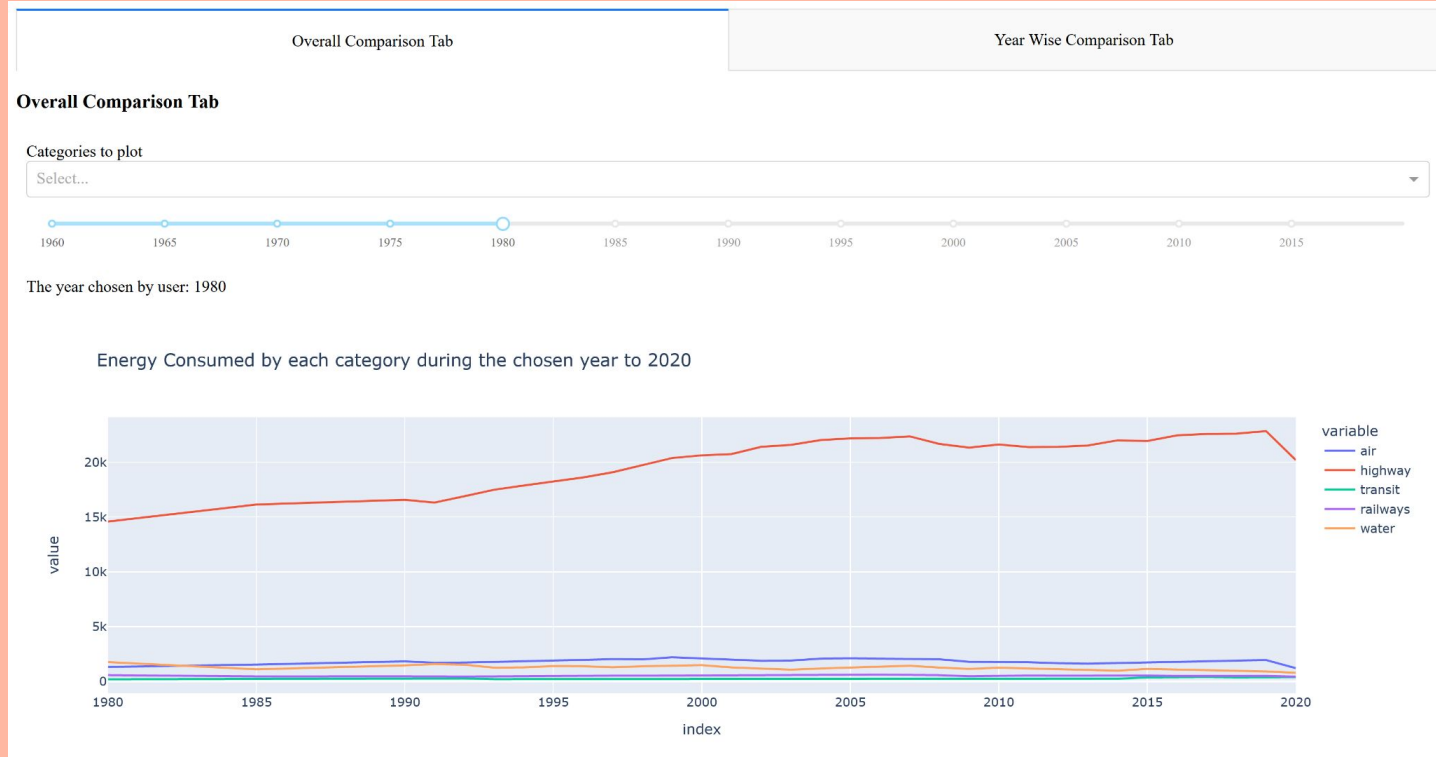


pandas



matplotlib

# Results



# Results

Overall Comparison Tab

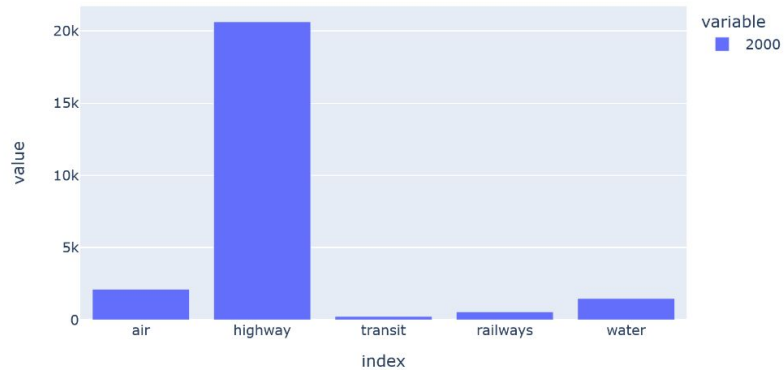
Year Wise Comparison Tab

Year Wise Comparison Tab

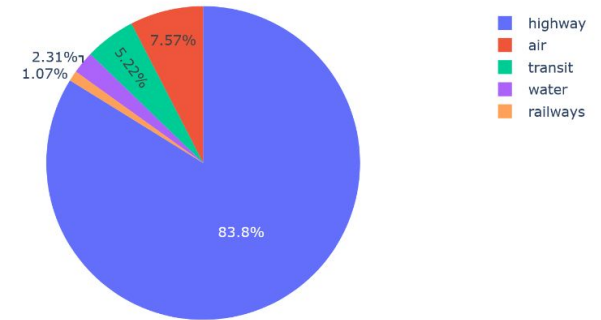


The bar chart is showing the data regarding year: 2000

Energy Consumption in Selected Year



Average Pollution Generated By Each Source over time



# Conclusions and Future work

- By observing the results, we can conclude transit transportation use minimal energy and cause less pollution. The highway transportation consumes high amount of energy and releases drastic amount of CO2 emissions. So, by reducing the usage of highway transportation we can reduce the pollution rate.
- We have calculated the percentage change of energy usage each year, the highest spike is witnessed as follows:

Air Difference            2020

Highway Difference    1965

Transit Difference      1970

Railways Difference    1985

Water Difference        1985

- To get more understanding, we can work on subsection of every mode of transportation , and get a detailed analysis.



Thank You

