Project Report:

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Project Title - "International Greenhouse Gas Emission"

About The Data-Set:

This project is based on a data-set from Kaggle.com,This dataset was kindly published by the United Nation on the UNData site.

The Greenhouse Gas (GHG) Inventory Data contains the most recently submitted information, covering the period from 1990 to the latest available year(2014), to the extent the data have been provided. The GHG data contain information on anthropogenic emissions by sources and removals by sinks of the following GHGs (carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), unspecified mix of HFCs and PFCs, sulphur hexafluoride (SF6) and nitrogen triflouride (NF3)) that are not controlled by the Montreal Protocol.

Methodology:

1. Data Cleaning

The data contained in this data-set was repeated, unclear and was having many "null" values included in it's available columns. The main complexity was the long string values included in one of the column, that was depicting the type of Green House Gas emitted by the countries.

My first aim was to clean the data and slice the lengthy string in the "category" column and grouping them by their updated indexes. Next various cleaning methodologies like clearing and replacing null values, finding discontinuous columns of data and the repeated data was performed phase by phase to get the quality data-set.

2. Data Visualization

For the analysis of data two types of visualizations were done;

A. Grouping the data according to the country name.

B. Grouping the data according to the category of emitted gas.

3. Analysis Report

(chronological Findings along with EDA)

i. The data itself is very irregular in-terms of distribution and labels. GHG(Indirect CO2) is a part of CO2 data. Hence CO2 is the most occurring Green House Gas. Also the HFC,PFC and HFC+PFC data can be overlapped, but the exact proportion is unknown. NF3 turns out to be occurred the least. Also GHG has a undefined label, we can't say exactly how much proportion of other gases are present or some of them are not present while labeling the data.

ii. GHG category has the maximum emitted amount, CO2 and indirect CO2, sums up to make CO2 maximum. NF3 has the least emitted amount.

iii. During Recession from Dec,2007-June,2009, **United States Of America** had a deep decline in emission of CO2. There may be many reasons, one being the decrease in purchasing power of automobile in USA or fall in Industrial development and production.May be United States of America has changed it's way of business and industrial laws after the Recession in 2009, that's why the emission value of CO2(direct and indirect) has increased till 2010.On the other hand, **Australia** had no such effects.It had almost uniform increase in the amount of CO2 emission during recession.

iv. May be after recession, **Denmark** had new laws on pollution control. There is a strong negative inclination.

v. **Japan** had a decrease in CO2 emission during recession, may be they were affected the most or any new law arrived which reduced the purchasing power of their countrymen. It requires more research. We need to compare the emission data country wise instead of gas types,that can give us a better research output.

vi. Before 1990, from 1950-1900, industrial work was at a peak in **Canada**. Cars, airplanes, steel, chemicals, appliances and other consumer goods were manufactured in Canada. By the 1960s and 1970s, approximately 30 per cent of the Canadian working population was in a union, often an industrial union. Major firms and manufacturing companies such as Massey-Ferguson, Bombardier, General Motors of Canada, the Dominion Steel and Coal Corporation and A.V. Roe Canada Limited dotted the industrial landscape. Till 1990, Canada has got a very good boost over their industrial(inclding Chemical) and automobile development, This can be one of the major reason for the increase in slope from 1990- 1995. After 1994, the rate of emission of CH4 declined, that may happened due to two reasons - First being the trade agreements such as the General Agreement on Tariffs and Trade/World Trade Organization, and regional trade pacts such as the Canada-United States Free Trade Agreement (1989) and the North American Free Trade Agreement (1994). Those trade deals effectively dismantled the protectionist approach of the National Policy. Hence the decrease in rate. Meanwhile, automation, innovation and productivity increases meant that fewer workers were necessary to produce manufactured goods. In the 2000s, auto assembly in Ontario faced restructuring and decline. The 1965 Auto Pact, a managed trade agreement that provided some guarantees for production in Canada, was found contrary to international trade rules, and the North American economy faced the financial crisis of 2008–09.

vii. After 2010, With an increasing amount of industrial work done by automation, including robotic processes, manufacturing work became less of a segment of the industrial economy. At the same time, computerization shifted much of the modern economy into the service sector, with retail, banking and finance, communications and other aspects of the economy outpacing manufacturing.

viii. **New Zealand** emits greenhouse gases which consists of around 45% CH4, 43% CO2 and around 11% N2O.This indirectly means,

   a) Methane emission occurs mainly because of Oil and Natural gas production and agricultural emission. In 2018, New Zealand's self-sufficiency in oil was 17%, i.e. the country imports its petroleum product needs. All local oil production is exported as the New Zealand refinery is not suited to processing it .

   b) So, New Zealand is unusual among developed countries with its strong base in primary production and a high proportion of electricity generated from renewable sources. As a result, almost half of the country’s greenhouse gas emissions come from agriculture, in the form of methane and nitrous oxide.

   c) The agriculture sector contributed 48 percent of New Zealand’s gross emissions in 2014. Methane accounts for 43 percent of all emissions (from all sources). More than 80 percent of New Zealand’s total methane comes from ruminant farm animals – cattle, sheep,goats and deer – mainly as a result of enteric fermentation. The great majority of that comes from the rumen, the enlarged modified foregut of ruminant animals. Only about three percent comes from animal manure.

   d) In New Zealand, most nitrous oxide is produced by the action of soil bacteria in urine patches in paddocks. Smaller amounts come from dung deposited during grazing, stored manures spread back onto pasture, and from nitrogen fertilizer.

ix. **Australia** produces CO2 maximum,moderate amount of CH4 and NO2, with a very small amount of N2O as per the available data. This indirectly means,

a) Australian industry broadly consists of mining, manufacturing, and construction,Energy Production,Agriculture, Forestry and Other Land Use (AFOLU), Transport, industries like - paper, food, petroleum refineries, chemicals and metal/mineral products & Residential, Commercial and Institutional Sectors, that are considered as carbon intensive industries.

b) Moderate emission of CH4 means, two aspects, one is the decay of organic wastes and other one is the production of oil and natural gas.

c) Australia holds 1,193,000,000 barrels of proven oil reserves as of 2016, ranking 38th in the world and accounting for about 0.1% of the world's total oil reserves. Australia has proven reserves equivalent to 2.9 times its annual consumption. Oil and Natural gas production industries in Australia are the main emitters of CH4.

d) Australians waste too much of food.The whole the country throws away three million tonnes of food per year. That's 145 kilograms per person, costing $6 billion. That's enough to food to feed us all for three weeks. May be this creates the most amount of the Organic Waste of the region. One important fact is that, Australia provides the service of commercial "Worm Farms", that is using Worms for the decomposition of organic waste. Farmers in Australia rely on compost and the municipalities have compost bins provided to the public use. This may be a secondary reason for this much CH4 emission.

e) In Australia, nitric acid is used to produce ammonium nitrate, and it is used by manufacturing companies to produce organic nitrates and inorganic nitrates. N2O is emitted during the production of HNO3.The Australia nitric acid market is expected to be valued at US$ 725.3 Mn in 2016 and is expected to grow 1.8X by the end of 2024 to be valued at US$ 1.3 Bn.The Australia nitric acid market is witnessing a new trend in the form of capacity expansions. In order to cater to an increasing demand for explosives from the mining industry, ammonium nitrate manufacturers in Australia are expanding their existing production facilities and are focusing on new production capacity additions.

f) Some adverse effect of this include the change of climate and temperature in Australia. In 2013, the CSIRO reported that Australia is becoming hotter, with an average increase of 1 degree celcius anually, and that it will experience more extreme heat and longer fire seasons because of the climate change. In 2014, the Bureau of Meteorology released a report on the state of Australia's climate that highlighted several key points, including the increase in Australia's temperatures and the increasing frequency of bush fires, droughts and floods, which have all been linked to climate change.

4. Conclusions

Most Of The Emission occurred due to the following reasons.

a) Agriculture (Responsible for Methane Emission)

b) Energy (Responsible for Carbon Dioxide Emission)

c) Industrial processes and product use (IPPU) (Responsible for Carbon Dioxide Emission)

d) Waste (Responsible for Methane Emission)

e) Land use, land-use change and forestry (LULUCF): The LULUCF sector keeps track of greenhouse gases from land use (Eg, for forests, crops, and pasture). This is separate from the livestock emissions reported in the Agriculture sector. It covers our use of soil, trees, plants, biomass, and timber and is the only sector where carbon dioxide is removed from the atmosphere.

Top 10 countries responsible for the Green House Gas Emission are,

i. United States of America

ii. European Union

iii. Russian Federation

iv. Japan

v. Germany

vi. Canada

vii. France

viii. Italy

ix. Ukraine

x. Australia

United State of America has contributed the maximum for the GHG emission in the world and **Carbon Dioxide** is the most emitted greenhouse gas.