Industrial Pattern Analysis of the United Kingdom using Hadoop

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ABSTRACT

This research has been made on the Energy Sector of the United Kingdom using a very large dataset which represents the list of companies/industries persisting all over the world under different domains. This project is focused on processing such huge dataset using commodity hardware under Hadoop[1] which is otherwise very hard to process using conventional software owing to the size of data. Our project signifies the utility of Hadoop in handling large datasets and furthermore lays out the study of current industrial pattern in the United Kingdom. Results are warning us about the continuous depletion of non-renewable resources in the region, especially coal and petroleum resources lying under the North Sea. We have laid out some future strategies which can be followed to save these resources and adopt renewable resources to more extent along with further investments in a nuclear sector which is a very promising source of energy for the region.

*Keywords:-*Big Data analytics, Hadoop, Energy sector, United Kingdom

I. INTRODUCTION

The energy sector of United Kingdom has a long history which contains extensive use of coal for 19th century needs of energy. The mid-20th century was an era of discovery of oil and petroleum resources under the North Sea which led to rise of the petroleum sector in the country for energy sources which was already on edge due to instability in coal sector owing to low profits. Since then, petroleum and natural gas have continued to be the major suppliers of energy in the country. The previous research compares the growth of different sectors from the late 1900s to 21st century which will be further verified by our results as we continue.
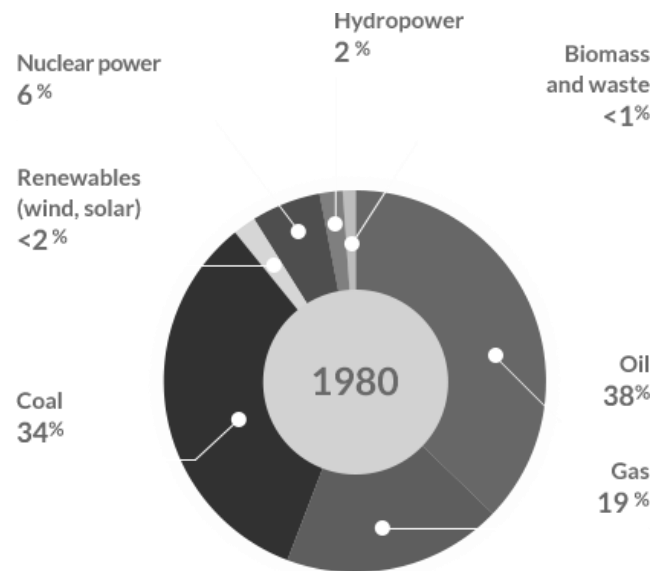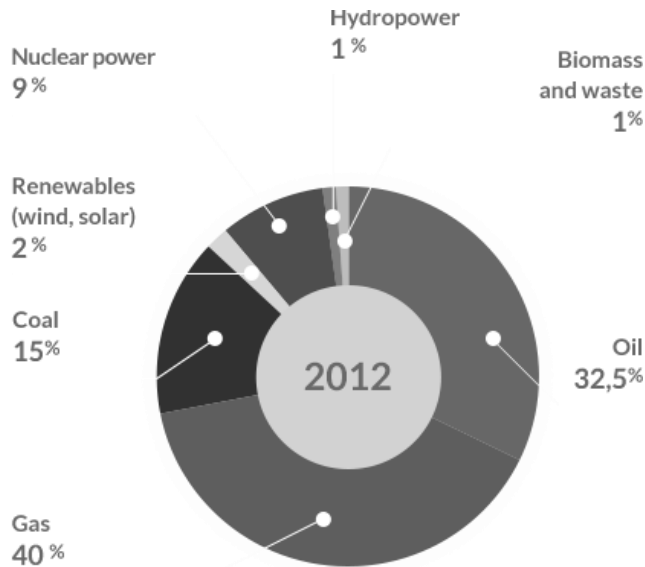
Fig. 1. Changes in the UK Energy Mix from 1970 to 2020

As we can see, the use of coal as energy source decreased significantly while natural gas and oil became the prime source of energy in the recent years.

The energy sector in the United Kingdom is constantly growing and it can be studied using large datasets available but these data sets can`t be processed using conventional software available. This is where our project comes into play where we use commodity software such as Cloudera to process such big data in minimum time using Hadoop technology. These tools would be able to handle huge sized dataset of companies which normally are found to be difficult to access in a fast manner to fetch relevant results.

II. METHODOLOGY

The Dataset of companies which is huge in size is first accessed through Cloudera software using Hadoop technology. Using this technology, various PIG script queries are coded down to use the dataset to give back all the results needed in minimal time. Those results are then converted into the graphical representation to study the pattern. That pattern is further analyzed to suggest future strategies which should be followed by the United Kingdom to preserve its resources as well as continue to fulfill its energy[3] requirements.

III. DATA RESULTS

We used different PIG queries to find out the number of industries/companies established in different domains of energy sector comparing them globally as well as internally and we got the following results:

Table 1 Comparison of energy sector industries in the United Kingdom at global level

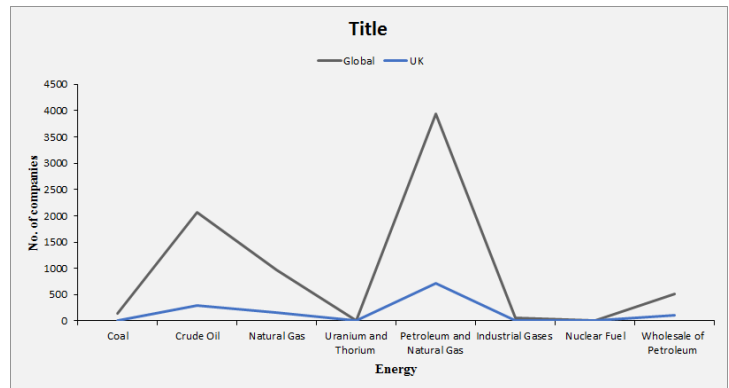| Energy Sectors	Number of Industries (Global)	Number of Industries (United Kingdom)
Coal	145	16
Crude	2061	295
Natural Gas	967	162
Uranium & Thorium	14	3
Petroleum & Natural Gas	3935	719
Industrial Gases	52	6
Nuclear Fuel	11	2
Wholesale of Petroleum	510	107

Fig. 2. Comparison of energy sector industries in the United Kingdom at global level
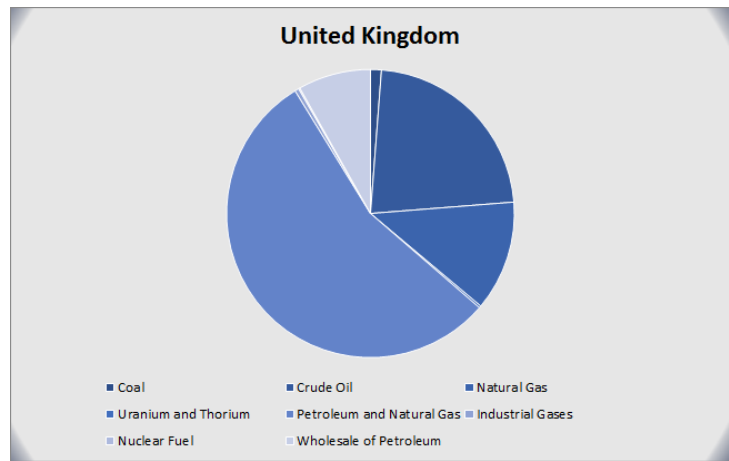

Fig. 3. Distribution of different domains of energy sectors inside the United Kingdom

After comparing the industrial sector of the United Kingdom at the global level, we further dug into the data to see the growth of energy sector in the United Kingdom since the 20th century and we came to the following conclusion after covering major sectors such as

- Coal
- Petroleum And Natural Gas
- Nuclear Fuel

Table 2 Internal distribution of domains of the energy sector in the United Kingdom

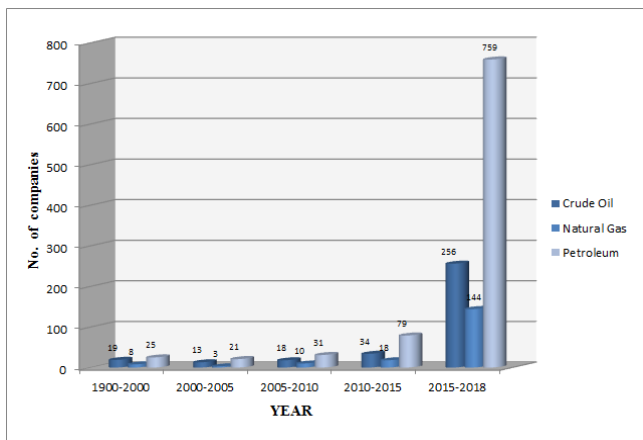| Energy Sectors	Number of Industries (United Kingdom)				
	1900-2000	2000-2005	2005-2010	2010-2015	2015-2018
COAL	3	0	0	4	9
CRUDE	19	13	18	34	256
NATURAL GAS	8	3	10	18	144
NUCLEAR FUEL	0	0	2	0	4
PETROLEUM	25	21	31	79	759

Compiling these results in graphical form, we get

Fig. 4. Internal distribution of domains of the energy sector in the United Kingdom

IV. ANALYSIS

The United Kingdom has always found to be endowed with energy resources. Our results in Table 1 clearly show that major portions of world's industry sector are situated in the United Kingdom. The United Kingdom is a significant producer of energy, especially in petroleum sector as out of 3935 industries, almost 700 are located in the United Kingdom. Owing to its past usage, the United Kingdom still houses 16 coal industries out of 145 all over the world.

Focusing on United Kingdom, figure 1 indicates that Petroleum and natural gas are the prime area of work for the United Kingdom in today's time. The petroleum sector provides energy to almost 10% of the United Kingdom which is quite big percentage compared to other countries. The results are quite a interesting as they are showing several ups and downs for various energy sectors in United Kingdom.

The country relied on coal mining in the early 1900s but the profit from coal industry declined after World War I as the history says which is the reason behind no growth in coal industry since the 21st century and after that, it tentatively ventured into nuclear energy in the mid-1950s. In the 1960s, the U.K. turned to the oil and natural gas buried below the North Sea. Although the country's natural resources are decreasing as our results are showing but the production of primary energy still accounts for 10% of Britain's Gross Domestic Product (GDP), a much higher share than in the majority of industrialized countries. Moreover, the analysis says that further exploitation of coal could have resulted in significant depletion of the resource.

Our results show a slight interest in the nuclear energy sector at the start of 21st century. This change was brought up to shift to renewable sources of energy in United Kingdom as constant exploitation of petroleum for energy needs was constantly depleting the resources.

Coming on the petroleum sector, this sector contains several ups and downs. History says the late 1900s was the peak time of production of petroleum in the United Kingdom. But the growth became steady at the start of the 21st century due to heavy production during 1999-2000. As the graph shows, the petroleum sector, although steadily, kept growing in the United Kingdom to supply energy needs in the country and continued to play the highest percentage in the country among energy sources.

V. CONCLUSION

The United Kingdom is the largest producer of oil and second-largest producer of natural gas in the European Union which can also be seen from our results. Due to steadily declining production since the early 2000s, the U.K. became a net importer of natural gas and oil. This decline can be verified by

the slow growth of industries in the petroleum sector in recent years which would have been drastic if the oil supplies would have been surplus.

Despite decreasing production, the U.K. remains one of the European Union's leading petroleum exporters which we signified in our previous analysis. U.K.'s increasing reliance on imported natural gas and oil will spur the government to develop energy policies to focus on enhanced oil and gas recovery. The U.K. has also invested in renewable energy. Continued delays in delivering nuclear and a lack of investors willing to come forward to fund new large gas generating plant could provide opportunities for a range of renewable energy technologies to be deployed at scale if the policy is supportive. The arrival of competitive energy storage solutions and the continued uptake of EVs, which also work at their best when deployed with renewable energy, will be a catalyst for accelerated deployment. If we move to a renewable world, then this will have a mix of large- and small-scale projects. This means that more companies will be able to enter the market creating more competition from the likes of renewable energy companies. A lot of future investment can come from new market entrants, such as farmers, businesses, and communities investing in on-site and local renewable energy generation.

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