JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Natural Resources Scarcity Forecasting

Ayub Shaikh , Danish Parve, Aditi Chavan, Preet Varma
Department of Electronic & Telecommunication
Rizvi College of Engineering , Mumbai- 400050, Maharashtra, India

Abstract : Natural Resource Prediction of the main constituent of living organisms, is crucial for economic and agricultural development particularly in arid areas where surface water resource is extremely scarce. Analysis and assessment of resources to collecting information often involve meteorological and hydrological components such as precipitation, flow, temperature etc. We are filtering this set of for analysis on different natural resources and estimate its availability in future and forecast its scarcity using Machine Learning. A statistical study of these natural resources is new and can make a significant contribution to the theory and practice of the efficient use of natural resources. The project plays an important role in formation of new business technologies for enterprises operating in the natural resources sector. The identification of extraction trends for natural resources can positively affect the rational use of natural resources on the regional level.

INTRODUCTION:

The World witnessed a major power crisis which led to many cities around the globe without electricity. The prices of natural gas, oil, coal and other energy sources have hit multi-year highs. Since energy prices affect economic decisions across the supply chain, the rise in prices has had a significant impact on economies with many companies in Europe and Asia shutting down unable to bear high energy costs.

The situation could well have been prevented if we have forecasted coal reserves availability 10-15 years ago. So, the World could have Prepared for alternatives.

Sufficient skilled human resources. This is a major challenge for the industry in general. Various downsizing exercises carried out by major oil companies over the past 20 years have distorted the industry's age pyramid and many professionals will reach retirement age in the next 10 years. The industry's image tends to make it less attractive for young, educated people than other "greener" industries, particularly in IEA countries. At the same time, due to shifts of production from industrialized to developing countries and the legitimate wish to favor the local work force in such countries, it is now becoming urgent to train large numbers of young professionals from many different nations. Providing adequate skilled staff is a well-known challenge in industry management circles and one that is being addressed, in part, by various players. While this topic is not discussed in this study, it is nevertheless worth stressing that attracting and training enough skilled professionals are going to be crucial to security of supply in a scenario where oil, gas, coal, etc. Remain a large component in energy.

There are many different natural resources reserves like oil, gold, natural gases, many industrial raw materials which might get depleted in future.

So, we have decided to do Exploratory Data Analysis on different natural resource Data and estimate its availability in future and forecast its scarcity using machine learning model.

One of the critical ratio's analysts use to measure the longevity of reserves is the reserve-to production ratio (R/P). The R/P estimates the number of years a reserve base will last at current annual production rates and is used by companies operating in the particular industry, as well as its producing countries. Reserves denote the amount of resource that can be technically recovered at a cost that is financially feasible at the present price of resource. Hence reserves will change with the price, unlike oil resources, which include all oil that can be technically recovered at any price. Reserves may be for a well, a reservoir, a field, a nation, or the world. Different classifications of reserves are related to their degree of certainty.

What Are the Reserves-to-Production Ratio?

The reserves-to-production ratio is an estimate of the number of years that the site of a natural resource will continue to be productive based on current production rates. The ratio is used to forecast many business factors such as the total income that can be expected to be earned from the source and the number of employees needed over its active lifespan. It also is a key factor in determining whether further exploration is needed to identify new sources of the natural resource. The reserves-to-production ratio is used to estimate the productive life of a particular site, such as an oil field. Alternatively, it may be used to project national or global availability of a natural resource.

The ratio is derived from two numbers:

1.The amount of a resource that is known to exist and that can feasibly be retrieved in the site being measured.

2.The amount of production that the site is currently yielding on an annual basis.

Limitation Existing system or Research gap:

Energy reserves are part of the energy resources that, based on technical, economic and other relevant (e.g., environmental) considerations, can be recovered and for which extraction is justified. The exact definition of reserves depends on the kind of resources in focus. Globally, the United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources (UNFC 2009) provides a scheme for classifying and evaluating these resources according to three dimensions, namely, their economic and social viability, the field project status and feasibility, and the geological knowledge about these resources.

System of Environmental Economic Accounting (SEEA)-Energy groups the detailed categories of UNFC into three aggregated classes characterizing the commercial recoverability of the resources as follows:
Class A: Commercially recoverable resources
Class B: Potentially commercially recoverable resources
Class C: Non – commercial and other known deposits
Thus, primary energy production relies on the capture or extraction of fuels or energy from natural energy flows, the biosphere and natural reserves of fossil fuels within the national territory in a form suitable for use mostly when extraction and sale have been confirmed to be economically viable. A good measure of the overall resource and the geographical and technical potential of what can be produced is also often represented by the potential in case of renewable power. India has one of the largest proven coal reserves in the world. However, one of the objectives of India's energy mix has been to promote the production of energy through the use of renewable energy sources in accordance with climate, environment and macroeconomic considerations in order to reduce dependence on fossil fuels, ensure security of supply and reduce emissions of CO2 and other greenhouse gases.
The reserves-to-production ratio is flawed. Estimates from 40 years ago showed the world as having 30 years of proven oil reserves left, meaning we should have run out by now. Then, 20 years later, the revised ratio concluded that we had 40 years of this critical energy resource left to extract. The lack of long-term reliability of the reserves-to-production ratio can be attributed to several factors. The lack of long-term reliability of the reserves-to-production ratio can be attributed to several factors. New Supply Sources Oil, Gas and Coal and other extractors are constantly identifying new natural resources to dig up. These discoveries dramatically change the ratio, prolonging the estimated time we have left before they run out. Technology Advances New technology can throw the ratio out of whack. Newer tools allow the extraction of oil that was previously considered impossible to get at a practical cost. That effectively changed the global reserves number and the value of the ratio.

SHIFTING CONSUMPTION:

- Another factor that the ratio fails to account for is the continually increasing demand for natural resources as the global population grows and new economic powerhouses emerge. As long as that trend continues, estimates of how much we have left in terms of years are likely to be overly generous.

PROBLEM:

- Natural resources by definition are materials from the Earth that are useful but are available in finite quantities. Finding them gets steadily more difficult and more expensive until they are tapped out completely. The natural process of restoring them takes ones. Meanwhile, we are relying on them to feed us, get us from point A to point B, and build many of the things that we have come to rely upon.

BACKGROUND:

- Energy policies are strongly influenced by resource availability and recoverability estimates. Yet these estimates are often highly uncertain, frequently incommensurable, and regularly contested. This paper explores how the uncertainties surrounding estimates of the availability of fossil fuels, biomass and critical metals are conceptualized and communicated. The contention is that a better understanding of the uncertainties surrounding resource estimates for both conventional and renewable energy resources can contribute to more effective policy decision making in the long term. Two complementary approaches for framing uncertainty are considered in detail: a descriptive typology of uncertainties and a framework that conceptualizes un-certainty as alternative states of incomplete knowledge. Both have the potential to be useful analytical and communication tools. For the three resource types considered here we find that data limitations, inconsistent definitions and the use of incommensurable methodologies present a pervasive problem that impedes comparison. Many aspects of resource uncertainty are also not commonly captured in the conventional resource classification schemes. This highlights the need for considerable care when developing and comparing aggregate resource estimates and when using these to inform strategic energy policy decisions.

Analysis: Exploratory Data Analysis refers to the critical process of performing initial investigations on data so as to discover patterns, to spot anomalies, to test hypothesis and to check assumptions with the help of summary statistics and graphical representations.

Libraries:

- NumPy and SciPy for numerical and scientific computations.
- Pandas for data manipulation.
- Matplotlib and seaborn for Data manipulation.
- Scikitlearn for machine learning
- Streamlit for web page development.

Algorithm:

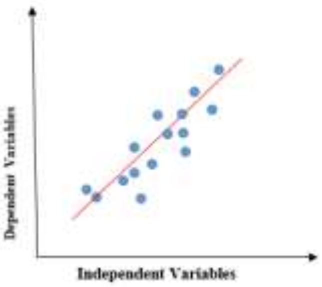
- Linear Regression is a machine learning algorithm based on supervised learning. It performs a regression task. Regression models a target prediction value based on independent variables.

- Different regression models differ based on – the kind of relationship between dependent and independent variables they are considering, and the number of independent variables getting used.

Linear regression performs the task to predict a dependent variable value (y) based on a given independent variable (x). So, this regression technique finds out a linear relationship between x (input) and y(output). Hence, the name is Linear Regression.

METHODOLOGY:

Linear regression is a quiet and simple statistical regression method used for predictive analysis and shows the relationship between the continuous variables. Linear regression shows the linear relationship between the independent variable (X-axis) and the dependent variable (Y-axis), consequently called linear regression. *If there is a single input variable (x), such linear regression is called simple linear regression. And if there is more than one input variable, such linear regression is called multiple linear regression*. The linear regression model gives a sloped straight line describing the relationship within the variables.



The above graph presents the linear relationship between the dependent variable and independent variables. When the value of x (**independent variable**) increases, the value of y (**dependent variable**) is likewise increasing. The red line is referred to as the best fit straight line. Based on the given data points, we try to plot a line that models the points the best.

To calculate best-fit line linear regression uses a traditional slope-intercept form.

$$y = mx+b \Longrightarrow y = a_0+a_1x$$

y= Dependent Variable.

x= Independent Variable.

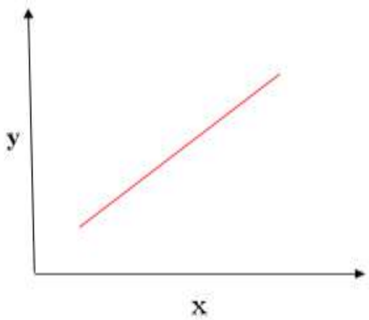
a0= intercept of the line.

a1 = Linear regression coefficient.

As mentioned above, Linear regression estimates the relationship between a dependent variable and an independent variable.

Positive Linear Relationship

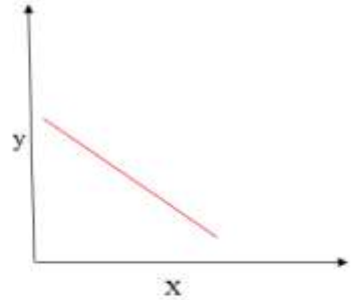
If the dependent variable expands on the Y-axis and the independent variable progress on X-axis, then such a relationship is termed a Positive linear relationship.



$y = a_0+a_1x$

Negative Linear Relationship

If the dependent variable decreases on the Y-axis and the independent variable increases on the X-axis, such a relationship is called a negative linear relationship.



$y = -a_0+a_1x$

The goal of the linear regression algorithm is to get the best values for a0 and a1 to find the best fit line. The best fit line should have the least error means the error between predicted values and actual values should be minimized.

Cost function

The cost function helps to figure out the best possible values for a0 and a1, which provides the best fit line for the data points.

Cost function optimizes the regression coefficients or weights and measures how a linear regression model is performing. The cost function is used to find the accuracy of the **mapping function** that maps the input variable to the output variable. This mapping function is also known as **the Hypothesis function**.

In Linear Regression, **Mean Squared Error (MSE)** cost function is used, which is the average of squared error that occurred between the predicted values and actual values.

By simple linear equation y=mx+b we can calculate MSE as:

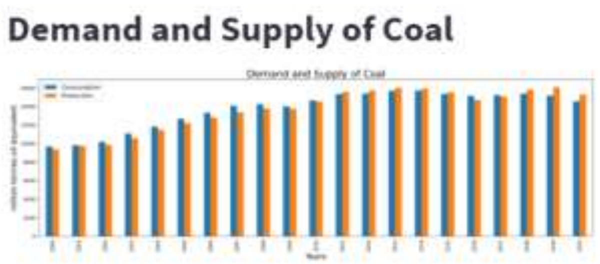
Let's y = actual values, y_i *= predicted values*

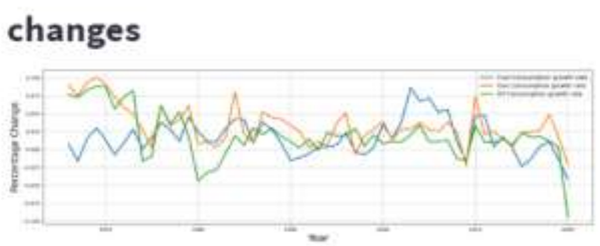
$$MSE = \frac{1}{N}\sum_{i=1}^{n}(y_i - (mx_i + b))^2$$

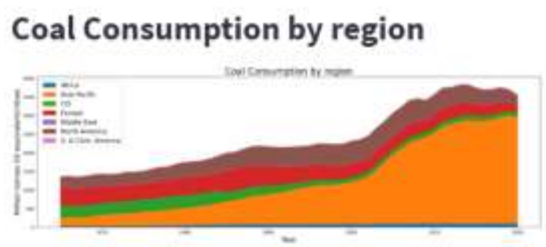
Using the MSE function, we will change the values of a0 and a1 such that the MSE value settles at the minima. Model parameters ***xi, b*** (a_0,a_1) can be manipulated to minimize the cost function. These parameters can be determined using the gradient descent method so that the cost function value is minimum.

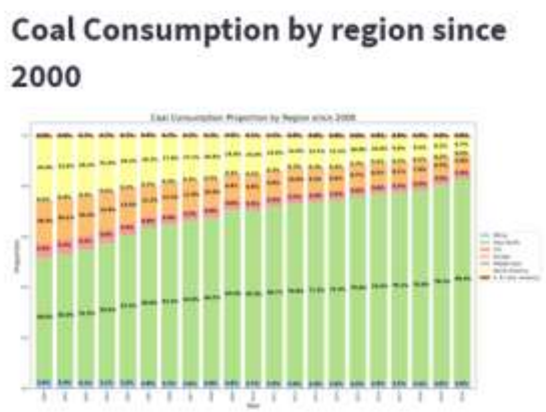
RESULT AND DISCUSSION:

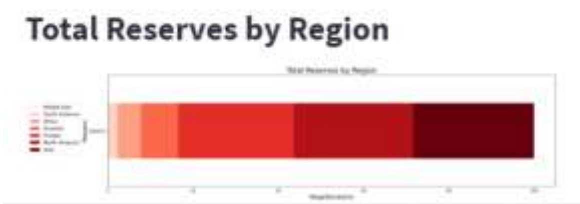
	Country	Year	[illegible]	Region	SubRegion
0	Algeria	1965	12.5503	Africa	Northern Africa
1	Algeria	1966	12.9026	Africa	Northern Africa
2	Algeria	1967	13.2790	Africa	Northern Africa
3	Algeria	1968	13.6636	Africa	Northern Africa
4	Algeria	1969	14.0617	Africa	Northern Africa
5	Algeria	1970	14.4650	Africa	Northern Africa
6	Algeria	1971	14.8723	Africa	Northern Africa
7	Algeria	1972	15.2860	Africa	Northern Africa
8	Algeria	1973	15.7098	Africa	Northern Africa
9	Algeria	1974	16.1490	Africa	Northern Africa



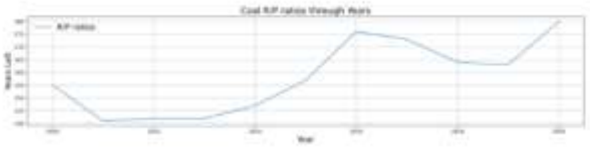








Coal RP ratios through Years



Conclusion:

Natural resources mostly used in Energy are slowly and steadily vaining out, putting the planet on verge of energy crisis and business losses. But the fact that these crisis can be foreseen and can led to future alternative development of sources of energy is important.

We have successfully done Exploratory Data Analysis of different Resources such as Oil, Coal and Natural Gases and successfully predicted the estimated year when we might faced resource scarcity. We plotted Demand and Supply, Region wise production and Consumption graphs, Year wise growth etc and used linear regression to fit the data and then finally got the Year using R/P Ratios.

Proper demand forecasting enables better planning and utilization of resources for business to be competitive. Forecasting is an integral part of demand management since it provides an estimate of the future demand and the basis for planning and making sound business decisions.

REFERENCES

[1] Statistical Review of World Energy 2021 | 70th edition.
[2] Machine Learning—A Review of Applications in Mineral Resource Estimation Nelson K. Dumakor-Dupey * and Sampurna Arya
[3] FORECASTING OF NATURAL RESOURCES USING ANN, M5TREE, ARIMA MODELS Bilwashree H R, Darshan R, Namitha N, H Srinivasa Murthy.
[4 A New Ore Grade Estimation Using Combine Machine Learning Algorithms Umit Emrah Kaplan 1,* and Erkan Topal 2.
[5] Resources to Reserves Oil & Gas Technologies for the Energy Markets of the Future
[6] ScienceDirect_articles.
[7] https://www.analyticsvidhya.com
[8] https://towardsdatascience.com