Analysis and Prediction of Power Generation in India Using Machine Learning

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***Abstract*: Investment in alternative energy sources should be made in order to decrease India's dependence on imported oil in order to attain energy security. In addition, India's annual energy supply is much lower than that of underdeveloped nations. However, because of the fast economic expansion and the potential for rapid industrial development, it is anticipated that the same would increase dramatically in the future. Sustainable energy has the ability to play a significant role in the industrialization and development of a country's economy. The ongoing industrial and economic growth is resulting in a substantial rise in overall energy consumption. In addition to boosting power supplies, sustainable energy will aid India in its efforts to combat climate change and mitigate global warming. In addition, as a consequence of higher returns on carbon offset debt under pure clean management, the long-term viability of alternative energy sources is enhanced. Other sustainable energy options will offer sustainable energy, enabling the nation to become less reliant on politically sensitive fuel imports while also decreasing greenhouse gases emissions. In order to expedite the growth of domestic energy supply, fluctuations in oil prices caused by global warming need the creation of a comprehensive, integrated energy plan. This paper explore analysis and prediction for Power Generation through Machine Learning.**

***Keywords*: Analysis and Prediction, Power Generation, Machine Learning**

I. INTRODUCTION

With the rapid growth of the global economy, more people are living in urban areas than in rural areas, which has led to greater growth in energy demand, especially in developing countries. The recognition that there is a shortage of available fuel sources for electricity generation and climate change due to carbon emissions has strengthened concerns about energy conservation and global protection. Climate change, electricity consumption, and foreign oil prices have become a global focus, among other recent issues. Sustainable energy sources are currently the fastest growing market for electricity mixing and offer significant opportunities to address concerns about energy efficiency and sustainability. Both countries are striving to meet the Kyoto Protocol's goal of reducing greenhouse gas emissions by focusing on their energy policies for clean energy while others have become more common in energy production. The energy we are currently using is based on unlimited use not only in global face-to-face calculations, but also in the process of converting energy into tangible and intangible waste that has a significant impact on the global environment. To ensure safe electricity supply, improve energy efficiency, reduce dependence on fossil fuels and reduce greenhouse gas emissions, the rise in clean energy is now a major challenge to our economic and environmental growth.

Types of Sustainable Energy Sources

Solar Energy

For thousands of years, humans have been using solar energy to cultivate vegetables, keep warm and dry food. "More electricity from the sun falls on the planet in one hour than anyone in the world uses in a year," said the National Sustainable Energy Laboratory. Today, we use the rays of the sun to heat homes and companies, to heat water, or to fuel supplies.

Fig. 1: Solar Energy

Solar, or photovoltaic (PV), silicone convert is produced in cells. Solar systems generate energy in the area, be it roof panels or community, home and business plans. Solar farms will generate indoor energy using mirrors to focus on the sun over hectares "floatovoltaics" and environmentally friendly water. Solar provides only. energy production. with about solar energy by 2017, gas is the second largest. Solar energy systems contain air pollution although safely available, little impact other than production.

Wind Energy
From ancient respiratory machines we come from afar. Today, high-tech turbines such as skyscraper turbines of large size are just a global focus. Wind power surrounds the rotor blades, providing the vehicle with power and generating electricity. Air has become a cheap energy source in many parts of the world, and accounts for more than 6 percent of US population. are high wind-powered nations, while turbines can be installed at high wind speeds anywhere - like high hills and open plains - or even out in open water.

Other Alternative Energy Sources

Hydroelectric Power
Major power projects, or waste, are also considered non-sustainable energy at the national and international level. Mega dams divert and reduce natural flow, restricting access to riverine animals and human communities. Small, carefully operated power dams with installed capacity of less than 40 megawatts, aim to minimize direct the.

Biomass Energy

Recent analysis, on the other hand, shows that most biomass sources, especially from plants, emit more carbon than fossil fuels. Biodiversity has many negative effects. Any type of biomass oil, however, can be a low carbon footprint in ideal conditions. Sawdust and sawmill stalks, for example, which can quickly decompose and emit fuel, can be converted into low-carbon energy.

Geothermal Energy

Fig. 2: Geothermal Energy

If you have ever bathed in a hot tub, you have seen geothermal energy. The centre of the planet is as hot as the wind of the sun, and radiation is eroding the earth's crust. When hydroelectric plants add smoke and water to a tank, they produce very little waste. Where there are no underground dams, underground hydropower plants can be built, but it is a concern.

Ocean
While the ocean currents and waves are still young, the oceans are still controlled by the gravitational pull of the moon, making it an attractive option to harness its power. Any seawater solution, such as dams, which act similarly to seas or lakes, can have an impact on biodiversity. Wave protection, such as the strength of the oceans, is achieved by structures such as dams or metal anchors along the coast.

Sustainable Energy in the Home
Solar Power
To lesser extent, use solar panels to power the entire building, or we can use PV. Vertical panels built with south-facing windows to let in light and conserve energy using cement, bricks, tiles, and other heat exchangers. Any electricity they use, more energy and return to the grid. In addition, batteries are relatively inexpensive to conserve a lot of solar energy for later use. Researchers are working hard on new technologies such as buildings for solar panels and roof tiles, including form and element.

Geothermal Heat Pumps
The spools on the back of the refrigerator small that releases inside food stable. Geothermal systems are a new system that can be seen. Geothermal pumps in the house use constant ground heat.

Selling the Energy
Houses powered by wind and solar, if provided by their energy supplier, will stand on their own or be connected to a wide electrical grid. In some countries, power suppliers simply pay for the difference between the power grid compared to what they produce - a method called net metering.

Clean Energy is Important

Electricity generation, in addition to all of our integrated driving and aviation resources, our # 1 gas-fired power plant, and sustainable technology often eliminate chemical fumes, toxic formations in the effects of mines. However, it takes time to restore our fuel infrastructure - as well as clear and reliable funding from government and regional authorities to improve energy efficiency and energy demand for customers and the company.

Reduce First

The conservation major in building future of sustainable use electricity whenever you press bath furnace. A typical home in the United States consumes about 11,000 kWh a year1 and most of that electricity is while protecting world using.
A little improvement saves a lot. Here are five steps you can take today to begin saving energy:

1. Use energy-efficient lighting such as CFLs or LED amps in your home and office
2. Turn the furnace into a warm place
3. Unplug your phone or mobile charger if you don't need them
4. Use energy-saving settings in the equipment and purchase equipment with an Energy Star label when converting.
5. Replace heater and air filters

Why Sustainable Energy

Sustainable technology provides individuals, businesses and the world with many benefits.

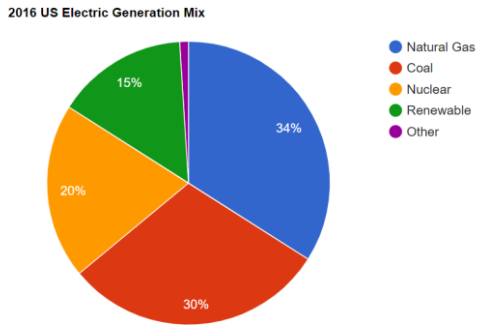

Fig. 3: Electric generation Mix

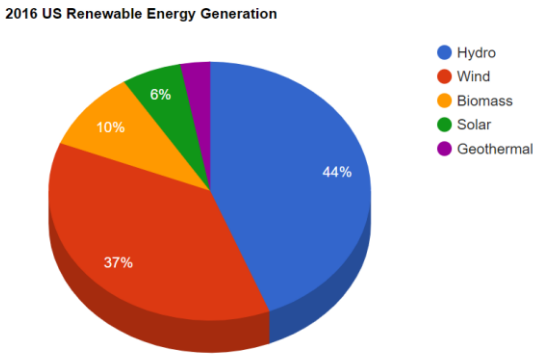

Fig. 4: Renewable Energy generation

The second major source of industrial air pollution in the United States is electricity generation. energy biomass, power sources. Our atmosphere is especially affected by the production of electricity, which polluted. The supply provide energy that is not too environmentally friendly. Radiation from green energy can be produced without the production of

The green powered by renewable, which is replenished over time without wasting Earth's resources. These tools are often numerous and accessible almost anywhere, causing few, if any, disruptions to the ecosystem. Examples of electricity from light, air and heat contained in the earth's surface. In contrast, green because limited - they can cease to be available as a source of sustainable energy until they are produced. Although made by natural systems, lazy people need, which means that things soon be lost.

Electricity Generation and it impact on Health

Sixty-six percent of the nation's related sulfur dioxide (SO2) emissions come from energy production. Sulfur dioxide causes asthma attacks in humans and leads to the production of fine particles, which are often harmful to lung health, according to the American Lung Association.

• 29% of nitrogen oxides (NOx) contributing to soil ozone and smoke by sunlight are found in energy production. The states that the risk of in.

• At low altitudes, however, land pollution causes an urban layer we call smog. The major contributors to the ozone layer are automobiles and energy production. Respiratory will contribute respiratory failure, infections, , children growing in areas with high ozone depletion.

• Particulate matter is often referred to as medicine or air as air pollution. The most common are respiratory manifestations.

Benefits and lacunas of sustainable energy

Wind, geothermal, solar, hydro and other sustainable technologies are a common source of energy worldwide today. Countries, companies and individuals use clean energy for a variety of important benefits. In this article we will examine some of the benefits of clean energy and its benefits.

Advantages of sustainable energy

There are many benefits to using crude energy over fossil fuels. Here are some of the best benefits of green:

1. Sustainable energy won't run out

Sustainable energy systems use environmentally friendly tools to generate electricity. Sunlight, wind, waves and biomass, among these energy sources, are some of the most common. Sustainable assets will not run out, which will not be mentioned in a few other types of fossil fuels it will be harder to produce while using petrol, which may push costs and impacts on manufacturing products.

2. Maintenance requirements are lower

In some cases, clean power systems require fewer general maintenance than generators using conventional fuels. This is because solar panels and wind turbines are produced with very few moving parts and are not dependent on fossil fuels for operation. Minor repair requirements lead to more time savings and resources.

3. Sustainable energy has numerous health and environmental benefits

Sustainable energy sources do not emit heat or pollution into the atmosphere. This translates into a soft carbon and an environmentally friendly effect. Not only do fossil fuels release carbon dioxide but they also release other harmful chemicals that cause respiratory and cardiovascular problems. It helps to reduce this pollution of sustainable energy and improve the natural quality of the atmosphere.

4. Renewables lower reliance on foreign energy sources

Raw energy technology can be used to generate energy at the local level. The less oil you consume in your fuel needs, the less energy you will rely on and contribute to the greater energy freedom in the United States.

Disadvantages of sustainable energy

Raw technology has many advantages, but sustainable energy is not enough. There are several pitfalls to standard oil in sustainable energy.

1. Advanced upfront cost

While sustainable technology can save you money, development is often more expensive in the beginning than conventional generators. Financial benefits, including tax liabilities and rebates, are also worth fighting for, in order to reduce start-up costs by green energy.

2. Intermittence

While the planet has clean energy options, most of seven. On most , the wind strong, the drought be prolonged. Unexpected natural events have the potential to disrupt this technology. Mineral oil is not always available; they can be turned on or off at any time.

3. Storing capabilities

The misalignment of certain green energy sources requires the use of energy storage. It is important to batteries work better.

4. Geographic boundaries

The United States of America is a geographically diverse country, with a wide range of habitats, topographies, trees, and other features. This creates a beautiful landscape of the plains, but some geographies are also converted to green technology with an open space, for example, is an ideal place for a while a shady downtown house with no tall buildings can benefit from any of the furniture in its house. There are other options clean energy by purchasing green energy or a community-based project if you are involved in the sun but do not have a sunny house.

Sustainable energy has more benefits than drawbacks

Hope for good exceeds hope when it comes to green power. Immediate, corporate or government change to green energy will not only contribute to savings. This will compare multiple local quotes, pre-installed to see how much your property costs and saves by registering with Energy Sage Solar Marketplace. Quotations also include estimates of greenhouse gas emissions that could be reduced by more than 20 years, measuring both planting trees and burning gallons of fuel.

II. METHODOLOGY

Data analysis is the process of interpreting and displaying, preventing and retrieving, and analysing data using statistical and / or logical processes on a regular basis. The various methods of delivery provide "a method of imaginative drawing from data and the separation of signal (event of interest) in sound (declining statistics) in data," according to Shamoo and Resnik (2003).

In quality science, data analysis can incorporate mathematical methods, but it often becomes a continuous process in which data is collected and analysed simultaneously. In fact, during the data collection phase, researchers often look at patterns of intensity style research type of data (field studies, material tests, oral history, profile, illiteracy) and the appropriate method used (field studies, ethnographic asset reviews, oral history, profile, illiteracy) (field notes, documents, audiotape, videotape).

Maintaining data integrity requires an accurate and adequate analysis of the research findings. The wrong approach analyses the negative effects of science, puzzles ordinary students, and has a detrimental effect on the public's expectations of research. Shepard (2002; Shepard, 2002; Shepard, 2002; Shepard Integrity issues are very important when it comes to analysing.

Having necessary skills to analyse

Investigators have been given enough instructions to demonstrate a good level of scientific process peacefully. An unintentional 'research error' may be the result of inadequate learning and non-compliance. Various studies suggest that this may be more likely than expected (Nowak, 1994; Silverman, Manson, 2003). These researchers reverse process in a 'statistical' analysis unit. Ideally, researchers may have something beyond the obvious reasons using learning allows researchers manage data analysts and make informed decisions.

Concurrently selecting data collection methods and appropriate analysis

While analytical methods may vary according to scientific discipline, the appropriate stage in the testing phase to determine the appropriate analysis process is rapid and should not be considered thereafter. "Mathematical guidance can be sought at the initial stage of preparation, according to Smeeton and Goda (2003), so that, for example, the process of sampling or compiling a questionnaire is appropriate."

Drawing unbiased inference

Main purpose the study where the actual result and the false result. Any bias in the data collection process or in the analysis of the analytical tool could raise the possibility of making a distorted conclusion. Failure to recruit a student may occur when the minimum number required to demonstrate mathematical power decreases or when the appropriate monitoring period is not required to confirm.

Reliability

Researchers conducting quantitative or qualitative analysis should keep in mind the efficiency and intensity of the problems. Gottschalk (1995), for example, discusses variations that may affect the reliability of data tested in the field of content analysis:

- Reproduce or size of class representatives to be divided equally
- Accuracy or level of textual classification corresponding to standard or standard
- Quality exists honestly prove that data analysis is stable, reproduced or accurate

The legitimacy of the content review report applies to category communication (classification where characters are selected for textual content) and to the performance of ideas (sections support the conclusion of the study and are found to have sufficient power to support or apply ideological choices selected?).

Extent of analysis

Raters should assign each code to the appropriate reference matrix group by entering the content review codes. Confidence in computer software may affect the accuracy of the frequency or the word count. "One can accurately count the incidence and frequency of this expression, but does not accurately answer the significance of each use" (Gottschalk, 1995). Additional analysis may new basic variables size or of the data collection.

When using statistical or non-statistical methods, researchers should be aware of the possible impairment of results. Although mathematical research is largely based on quantitative data, various analytical processes, such as text analysis, thematic, and ethnographic, are designed primarily for quality data. When studying measurement or quality scenarios, scholars use a variety of tools to interpret information to validate thinking, differentiate behavioral styles learning accept processing may damage the quality of the data.

1. Regression analysis

Regression analysis is a way to measure relationships between a set of variables. During the whole retrospective study, you are trying to find out if there is a relationship between dependent variables (the outcome or variable you want to test or evaluate first) and a series of independent variables (factors that may influence dependent variables).

Your personal difference is the use of social media; you want to see if it has an impact on sales and, more importantly, if you have to increase, decrease or fund. You can use mathematical analysis to see how the two variations are related. A good meeting can mean. No organization can claim that social network marketing will not affect revenue. Understanding the connection between the two will allow you to make better decisions on the cost of communication. However: It should be noted that retrospective should only be used on their own to determine whether a link exists or not between a series of variables - they say little about cause and effect. While there may be a strong correlation between the amount spent on social media and the sales revenue, it is not possible to draw complete conclusions on the basis of this research alone.

Time series analysis

By examining time-related patterns, observers will be able to predict how the anxiety factor will change in the future. When you do time research, the key themes in your data are:

Trends: Stable, direct intensity increases or decreases over time.

Unexpected variability of data in the short term due to seasonal influences. For example, you can see the high cost of selling swimming equipment every year at the same time in the summer.

Unexpected times when information changes. Cyclic styles are not caused by the time of year, but may be due to economic or industrial conditions.

III. Analysis and Simulative Result

In India, imported fossil fuels meet many commercial energy needs. India was the fourth largest producer in the world and imported oil and petroleum products in 2013. As the country relies heavily on imports, any shortcomings caused by the unpredictable political situation could lead to power shortages, hampering industrial development and economic development. To achieve energy security, India should reduce its reliance on imported oil by investing in other energy sources. Annual electricity supply to India is also much lower than in developing countries. However, it is expected that the same will rise sharply due to rapid economic growth and the potential for rapid industrial development. Sustainable energy has the potential to play an important role in industrialization and nation growth. Due to continuous industrial and economic development, total energy consumption increases significantly. Sustainable energy will help India in the fight against climate change in addition to increasing electricity supply. As a result of increased yields on carbon offset debt under pure clean management, the sustainability of other energy sources is also improved. Other sustainable energy solutions will provide sustainable energy, allowing the country to be independent of politically sensitive fuel imports while reducing greenhouse gas emissions. Fluctuations in oil prices as a result of global warming require a specific, integrated energy strategy to accelerate the development of domestic energy supply.

Model Building

Data is designed for line deflection (Machine Learning).

```
from sklearn.linear_model import LinearRegression

lm = LinearRegression()
lm.fit(X_train,y_train)
```

```
LinearRegression()
```

```
print(lm.intercept_)
```

```
16215.95934714119
```

```
predictions = lm.predict(X_test)
```

```
# R_square
sse = np.sum((predictions - y_test)**2)
sst = np.sum((y_test - y_test.mean())**2)
R_square = 1 - (sse/sst)
print('R square obtain for normal equation method is :',R_square)
```

```
R square obtain for normal equation method is : 0.5862575451525164
```

Fig. 5: Linear regression model

```
plt.scatter(y_test,predictions)
```

```
<matplotlib.collections.PathCollection at 0x1c21a674f10>
```

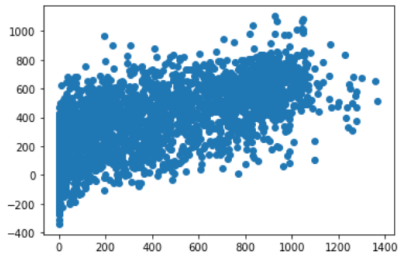

Fig. 6: Scatter plot

sns.distplot ((y_test-prediction));

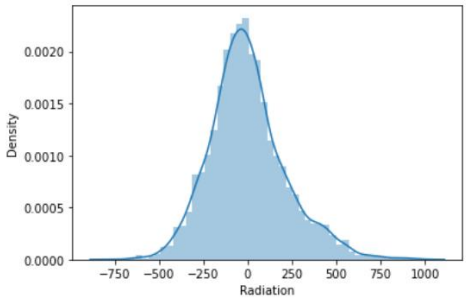

Fig. 7: Radiation density

```
f = plt.figure(figsize=(14,5))
ax = f.add_subplot(121)
sns.scatterplot(y_test,predictions,ax=ax,color='r')
ax.set_title('Check for Linearity:\n Actual Vs Predicted value')

# Check for Residual normality & mean
ax = f.add_subplot(122)
sns.distplot((y_test - predictions),ax=ax,color='b')
ax.axvline((y_test - predictions).mean(),color='k',linestyle='--')
ax.set_title('Check for Residual normality & mean: \n Residual eror');
```

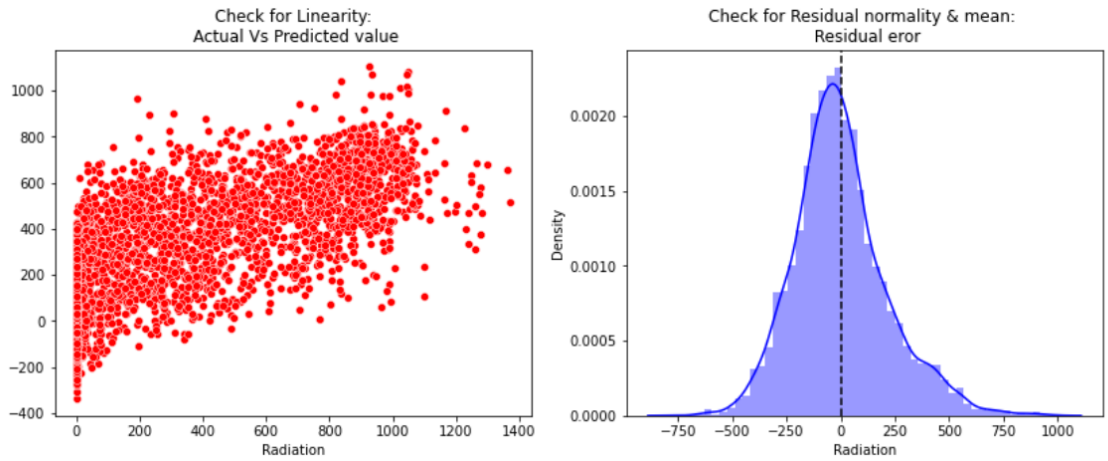

Fig. 8: (a) Check for linearity actual and prediction value (b) check for residual normality and Mean : Residual Error

```
from sklearn import metrics

print('MAE:', metrics.mean_absolute_error(y_test, predictions))
print('MSE:', metrics.mean_squared_error(y_test, predictions))
print('RMSE:', np.sqrt(metrics.mean_squared_error(y_test, predictions)))
```

```
MAE: 164.01092615992266
MSE: 46590.01134387128
RMSE: 215.8471944313182
```

Fig. 9: Fully evaluated solar pattern

As the above graph is made to predict and fully evaluate the solar pattern with machine learning techniques.

IV. Conclusion and Future Scope

India needs to develop more energy sources to rely on imported oil to achieve energy stability. Moreover, the average energy consumption per person in India is much lower than that of the developed world. Due to rapid economic development and rapid production capacity, the same is expected to grow significantly. Sustainable energy has the potential to play an important role in the country's industry and development. Demand for general residual energy is expected to grow significantly in the near future as a result of sustainable growth and economic growth. In addition to supporting India's power supply, sustainable technology will help the country fight climate change. The availability of sustainable energy is also being increased due to expanded products from carbon offset grants under clean growth management. Overall, the clean energy market, along with its application list, has evolved and expanded significantly. For this reason, a comprehensive plan needs to be developed to identify the need and provide the necessary services for the construction of sustainable energy. The actual state of sustainable energy and the predicted applications of sustainable energy must be understood in order to perform the task. Investigate clean energy as a potential future source of supply and demand.

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