ENERGY CONSUMPTION AND ENERGY GROWTH

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ABSTRACT

Climate change is one of the world's major pressing challenges. "Human emissions of greenhouse gases – methane, CO_2 nitrous oxide and others have enlarged global temperature. The linkage between economic growth and emission has been issue of deep research over the past few decades. Rising energy demand stimulates GDP, but energy consumption too leads to greenhouse gas emissions. Increasing attention to global warming and climate change has concerned the nexus between energy consumption, economic growth and environmental pollutants. Thus the present paper tries to study the impact of the growing energy needs and the economic growth of a country by establishing a relationship between them.

Key Words- Climate Change, Carbon emissions, Economic Growth, Kuznets Curve.

INTRODUCTION

The issue of "environmental degradation" is one of the considerable challenges of our time. The consequences of the massive pollution that has been going on for several years are frightful for both short and long run as well as on a regional and general scale. Energy is essential component of any modern economy. It is a pivotal input to nearly all of the goods and services we have today. Energy plays a climatic part in the socio-economic development and human welfare of a country.

One of the major contributors to climate change is the increase of greenhouse gases in the environment in particular CO_2 that rise from the burning of fossil fuels (coal, oil and natural gases).There are relatedness between the performance of the economy , as measured by GDP, all round of raw materials, arising in waste products , which may distress the environment. Economic growth of countries require, all inclusive use of energy which result in enlarging of co2 emissions, So pollution is directly related with economic development and growth.

CO_2 emissions are increasing throughout the world. Most advanced nations are with some of the highest per capita emissions like USA. The nations like China with its high

energy consumption places itself on first place in combusting of the CO_2 emissions from the last few years. In India, the largest driver of the all-inclusive greenhouse gas emissions is carbon dioxide emissions from fuel combustion.
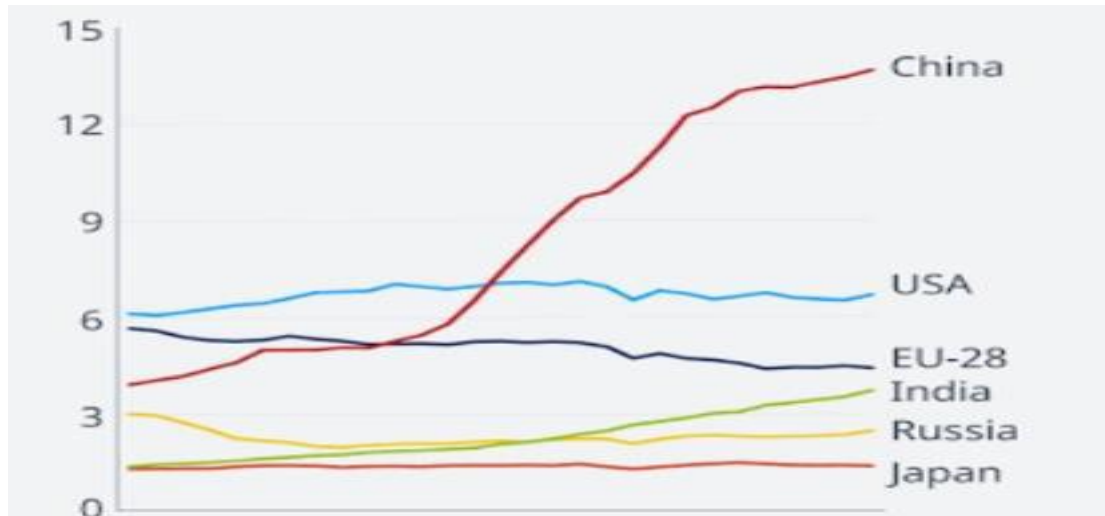
Figure 1: Top 5 CO_2 emitting countries

The below three variables are inter- related with each other one cause will effect another one. Energy consumption leads to economic growth whereas the development and growth effect the Environment and generate CO2 emissions.

Objectives

The research work focus on analysis the relationship between the three variables which are:

Energy consumption, Emissions and Economic growth.

The main objective of the study to analyse the relationship between Energy consumption and CO_2 emissions and with Economic growth, how energy consumption explains the CO_2 emissions and influences environmental degradation through Environmental Kuznets curve.

Methodology

The study is entirely based on the use of the data from the secondary sources and data has been collected from a number of reliable sources like IEA, World Economic Forum, CO_2 Earth and from other websites such as statista, worldometer, world economic outlook and from the IPCC climate change report. The study analyses the trends of the Energy, CO_2 emissions and GDP.

LITERATURE REVIEW

Kraft and Kraft (1978) The research focused mainly on examining the relationship between Economic growth and Energy Consumption.The study used the U.S annual data on total employment and Energy Consumption between the time period of 1947-1974. The study analyzed the relationship between the Energy Consumption and GNP. The result showed that there is a causality coming from Economic Growth to Energy Consumption, which means that unidirectional causality from GDP to Energy Consumption dominates the economy of U.S. Such finding inferred that Energy Conservation policies may not have adversely impact on Economic activities.

Stern (2000) The study explained the relationship between Economic growth and Energy Consumption using "annual data of the time period 1990s. The study work tested for Granger causality" in a multivariate setting, used vector auto regression (VAR) model of GDP, labor and capital inputs, and a quality adjusted index of Energy input. When the multivariate and quality adjusted both approach employed," the finding showed that Energy Granger caused GDP (Economic growth).

Kander (2002) The research paper studied the causal linkage between Energy consumption, Economic growth and Emission. The objective of the study was to establish Energy intensity and CO2 intensity. Study used the annual data for time period 1800-2000 for the Sweden economy and analyzed the reasons for trends and trends break. The study found that Economic growth leans on the energy at man's disposal. Energy intensity experienced a long term decline over the period 1800-2000, it declined approximately 84 %. Structural changes at sector level, integrated with strong increase of energy intensity where as the technical changes generally worked to decrease energy intensity. The hypothesis that high growth rates are better against the low growth rates for the Environment was tested with respect to energy intensity which implied that no correlation was found between energy and high growth of GDP.

Hossain (2012) examined the relationship between Energy, CO_2, Economic Growth, urbanization and foreign trade. Empirical study suggested the growth Hypothesis. The study is based on time series data for the time period 1960-2009 in Japan. Results of the study revealed that the long term of elasticity of CO_2 with respect to energy consumption is (1.08) high and over time higher energy consumption, would lead to more CO_2 emission in Japan and the country would get more polluted. The study also found a unidirectional relationship

between CO_2 emission and economic growth, implying policies to reduce the emissions would hinder the economic growth of the country resulting in a vast unemployment rate. With respect to energy the work analyzed that energy consumption has increased with the enlargement of industrial output for economic development in Japan leading to high CO_2 emissions, which means that "Energy Consumption has a significant positive impact on CO_2 emission.

Sterpu and Mehedintu (2018) The study analyzed the relationship between GDP per capita income, Greenhouse gases Emission and Renewable Energy Consumption. The study showed for a panel of 28 European Union Countries for the time period of 1990-2010. They used two theoretical models, a cubic and quadratic one for the estimation of Environmental curve shape and for testing the Kuznets Hypothesis. The results from co-integration approach provided the subsistence of long run equilibrium linked among the macroeconomics indicators. They tested the validity of" EKC Hypothesis", by analysis study found that the estimation of GIC were positive whereas the REC negative, which means that in long run increment in GIC leads to increase in GHG Emissions.

RESULTS AND DISCUSSIONS

The CO2 Emissions change since Kyoto protocol is shown by below inserted table, The following table 1 shows the top emitted countries China, USA, India, Russia and Japan percentage change since 1992 and there percentage of global share.

Table 1

COUNTRIES	% Global share	% Change
China	27%	54.5%
US	15.2%	-12%
India	7.2%	10%
Russia	4.2%	6%
Japan	3.5%	-10.2%
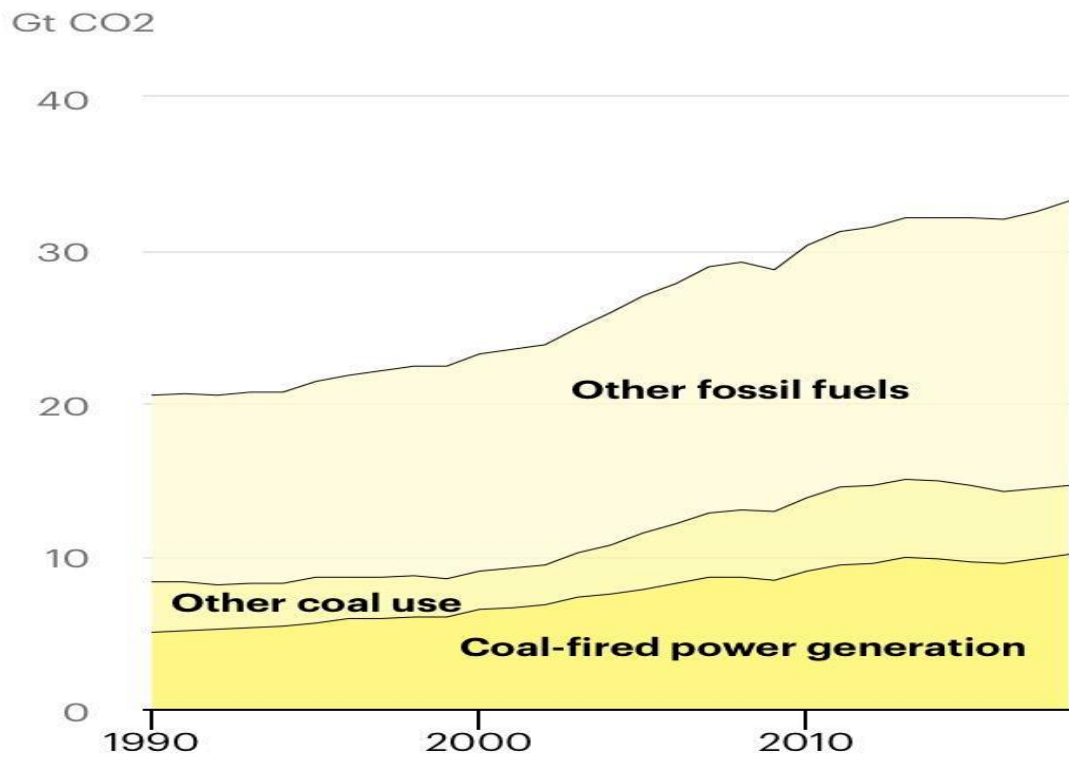
Figure 2: CO$_2$ regional trends

The regional trends for CO2 emissions for the nation **U.S,** largest declined in Energy-related CO2 emissions in 2019, from 2.9% to 4.8. where as in **EU**, it dropped by 5% to 2.9. In **Japan**, it reduced by 4.3% to 1.30. where as in **China**, the CO2 emissions rose and in **India** CO2 emissions was moderate.
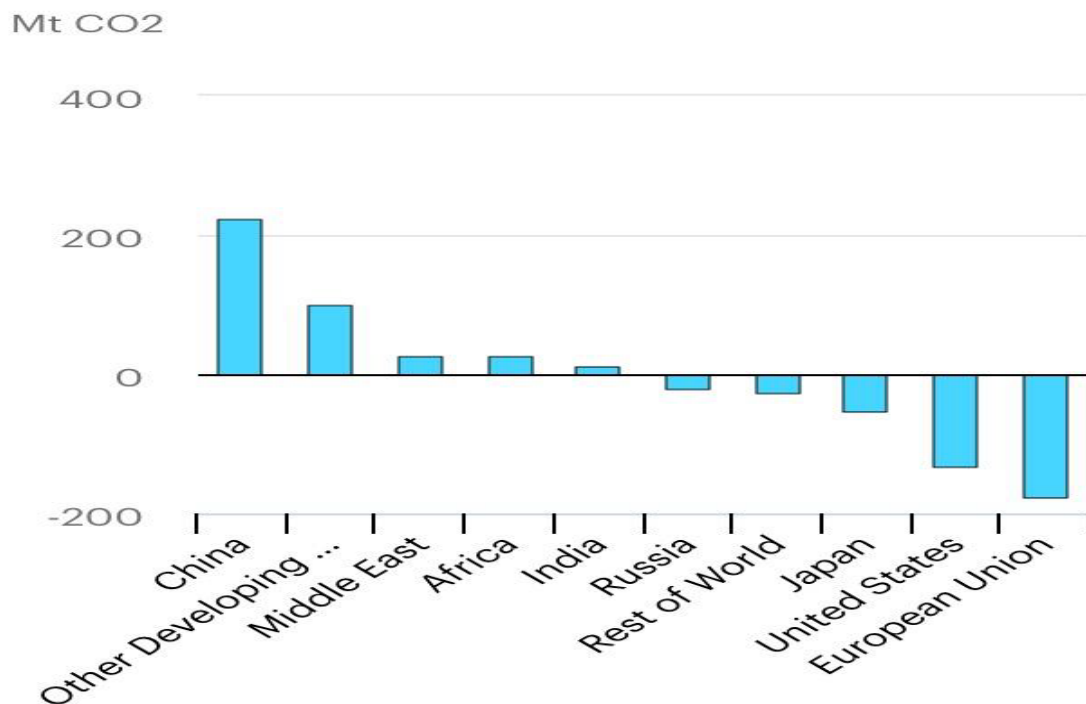
Figure 3: CO$_2$ emissions regional trends

Analysis of the relationship between Economic Growth and CO$_2$ Emissions

Widening income inequality and environmental degradation in relation to economic growth have progressively become pressing matter of concern. "The inverted U- shaped relationship between GDP and pollutant, referred to as the Environmental Kuznets curve (EKC), which is firstly introduced by Kuznets (1955).

The EKC is a hypothesized relationship between Environmental quality and economic development. This hypothesis which advocates a U- shaped or inverted U- shaped linkage between two variables, implies a non linear relationship. Carbon dioxide (CO$_2$) is considered as the major element of emissions of the greenhouse gases and is a crucial source of Environmental problems.

In consonance with the EKC hypothesis, CO$_2$ emissions are assumed to have a positive relationship with the level of income before the environmental Kuznets threshold and then a inverse relationship beyond the threshold. The EKC configuration suggests "the existence of of an inverted U – shaped relationship between GDP and Environmental pollution." As per the Environmental Kuznets Curve (EKC), the atmosphere of a country degenerate in the early stages of the growth. After the precise level of the economic growth,

the country begins to refine its relationship with the environment and the level of environmental pollutants reduced.

It can be understood by the following diagram of the EKC by using GDP level with emissions (CO_2).
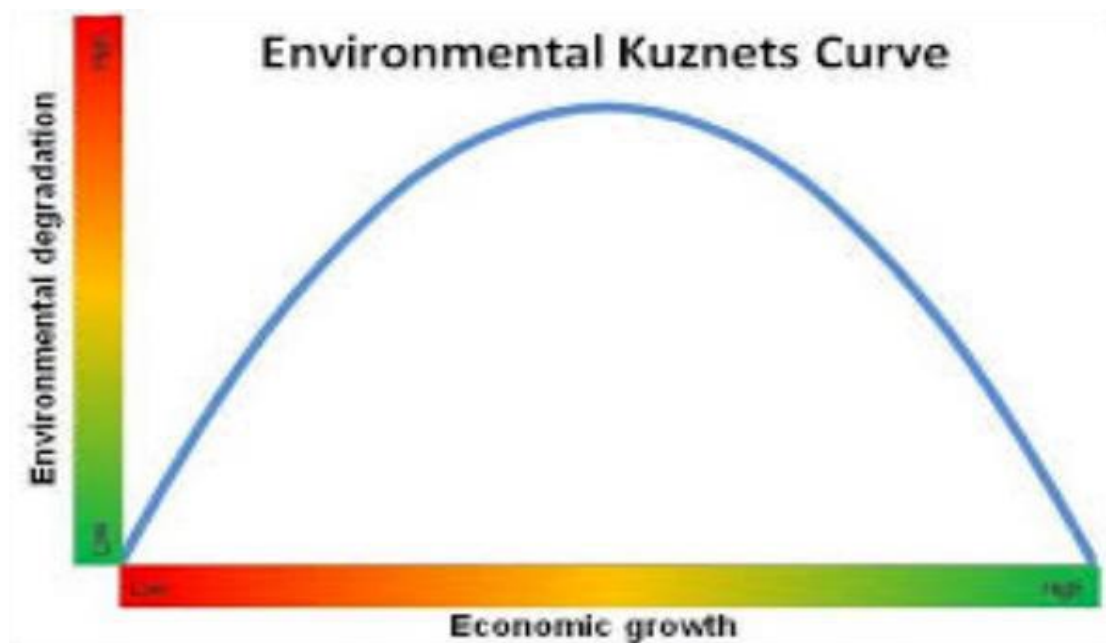
Figure 4: Environmenal Kuznets Curve

Thus, in order to investigate the relationship between Economic growth and Environmental degradation through the EKC theory of the top emitters countries which are U.S, China, India, EU and Japan shows the following estimates.

In case of **India**, the developing nation pollution is rising beyond the carrying capacity of the Environment. Natural resources are being over used and there is extensive discharge of waste in the atmosphere. Currently, India is on the upper side of the EKC, for maintaining the sustainable growth, it must advance to the second stage.

ENVIRONMENT DEGRADATION
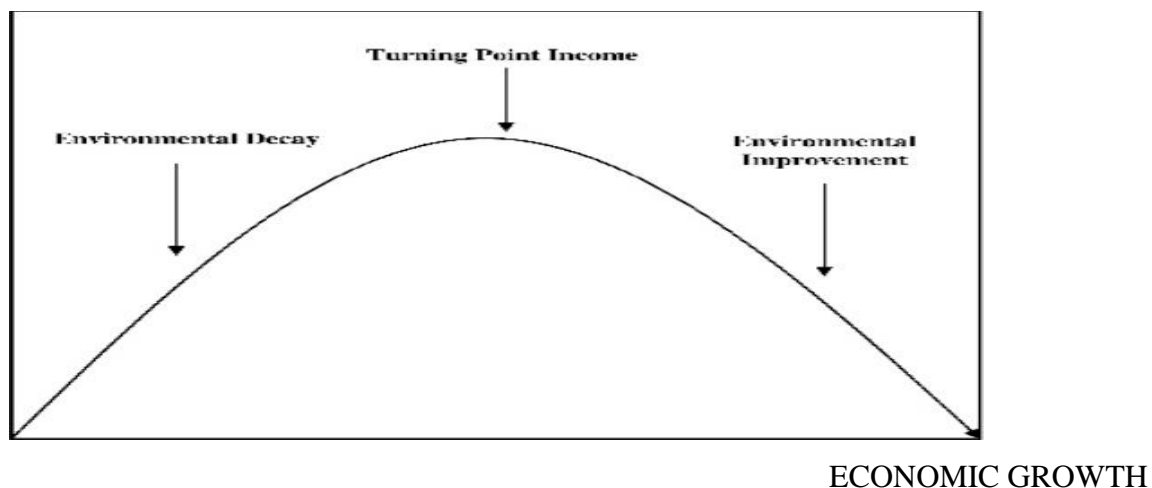
ECONOMIC GROWTH

Figure 5:Environmental Kuznets Hypothesis Curve

Further for the **Japan** the relationship between environmental pollutants and the economic growth through the EKC, shows the U- inverted shaped curve which means the presence shows the support of EKC. Rise in GDP in turn rise the increase in emissions. Although, it is not basically statistically significant and thereby stiff to dictate that there exists a decreasing part.

In case of **United States**, the EKC theory examines that the US, which is the second largest emitter nation among the nations support the presence of the EKC and there exist correlation with the Energy consumption.

In case of **China**, the evidence supports the presence EKC hypothesis. CO_2 emissions initially rise and then decline after reaching with a turning point in economic development. It exceeded the US as the largest CO2 emitter in 2008 and exists on number 1 spot.

In case of **European Union**, the study shows that the EU countries followed the Environmental Kuznets curve, analyzing the relationship between Co2 emissions and GDP, it is statistically significant.

Policy measures to reduce impact of CO_2 emissions

To reduce the impact of CO2 emissions it is must for countries to improve energy efficiency through Energy conservation and govt. policies by reducing energy consumption and by increased efficient use of energy, it can result in increased environmental quality and financial capital.

Climate change's negative impacts can be reduced by practicing energy efficiency, greater use of renewable energy resources, by promoting the benefits of sustainable agro-forestry and

by enhancing green growth. Further effective plans, projects and policies of each countries government can maintain the quality of environment and sustain economic growth.

CONCLUSION

The finding of the work also showed that economic growth specifies an increase in economic activities influence contradictory on the environment and increase in carbon emissions. In relationship between energy and emissions, there is high relation exist as with increase in energy there is an increasing emissions trend. The primary sources of energy are fossil fuel based in high energy consuming countries (China, India). Energy consumption vary from across the countries as the study analysis that the china which is the most energy consumption nation followed by the USA. The variations in consumption pattern of energy across the nations are mainly due to the geographical factors, economic structure, technology, environment and climate.

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