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Renewables Share and Fossil Fuel Prices, Carbon Emissions and Global Warming: A Case Study of German Electricity Market

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Abstract:- Human activities to achieve stable economic growth has contributed substantially to global warming and pollution because of emission of carbon dioxide and other heat trapping gases. I studied the Germany Electricity market, Renewables share in total Electricity production, carbon emissions from 1985 to 2020. And for the empirically analysis, I used datasets from ESTAT and Federal Ministry for Economic affairs and Energy (BMWi) Germany and checked the impact of fossil fuel prices on electricity share coming from renewables. Which showed insignificant results with fossil fuels price and showed significant relationship with carbon emissions and global rising temperatures. Which shows there doesn't exist a relationship with prices but does with global warming and carbon emissions.

Keywords:- *Renewables, Global warming, Fossil fuels, Electricity production.*

I. INTRODUCTION

Renewable Energy refers to a form of energy that is naturally obtained from the sources which are environment friendly and that can be recycled or replenished. Most of the known renewables are solar energy, hydropower, geothermal, wind energy, and biomass energy (Walter Leal Filho, 2021). We need energy every single day of our lives from providing fuels to our homes, offices, hospitals, schools, everywhere either with domestic oil or electricity from national grids for lighting, heating and to empower our electronic devices. Electricity was one of the birthplace of moving forward and progression in the Industrial Revolution (E. A Wrigley, 2013). In 1831, Faraday discovered an electric current and it emerged as a revolutionary change in economy as they succeeded to build an electric generator in 1832. And ever since, the use of electricity marked significant growth in every sector of life. And it marked the development of electrical powered machines to replace steam powered machines in industry. And in 1870 first electric motor was built and it completely changed the industrial sector (Hirshfeld, 2006).

Since the industrial Revolution, demand for energy increased immensely and across the world fossil fuels have seen significant growth for the production of electricity. As an economy grows, so does the pollution causing sever threats to human health and global climate. Burning of fossil fuels for the sake of energy has caused three-quarters emissions of greenhouse gases, air pollution, and premature deaths. Pollution has caused at least more than five million premature deaths every year. Due to air pollution and emission of toxic and hazardous air pollutants, gases like hydrogen chloride, dioxin, benzene, compounds like asbestos and elements such as mercury, chromium and cadmium, Millions of people are under threat. Because of theses toxic pollutants people may experience irritation of the eyes, coughing, breathing difficulties, birth problems, lung and heart problems and urban smog etc. (WHO).

The industrial revolution introduced the new transition in manufacturing in Great Britain, Central Europe and the United States during 1750 to 1820. By mid of 19^{th} century, industrial revolution brought a significant shift in energy sources and the demand for energy was felt very high to fulfill the domestic and industrial needs. During 2005, the worldwide consumption of fossil primary energy carriers and of hydropower amounted to approx. 441EJ/1-3/ (Kaltschmitt, and Streicher,2007). The statistics showed 28% of the overall energy consumption account for Europe, 27% for North America, about 5% for Central and South America, 5% for Middle East, 3% for Africa and 32% for Asia and pacific region. Around 90% energy driven from the fossil energy carried by North America, Europe and Asia.

As for the environmental pollution, $CO_2$is now reaching 50% higher than before the industrial revolution and the research showed during March 2021 the atmospheric level exceeded 417 parts per million for Mauna Lao whereas the pre industrial level of CO_2 was 278ppm.

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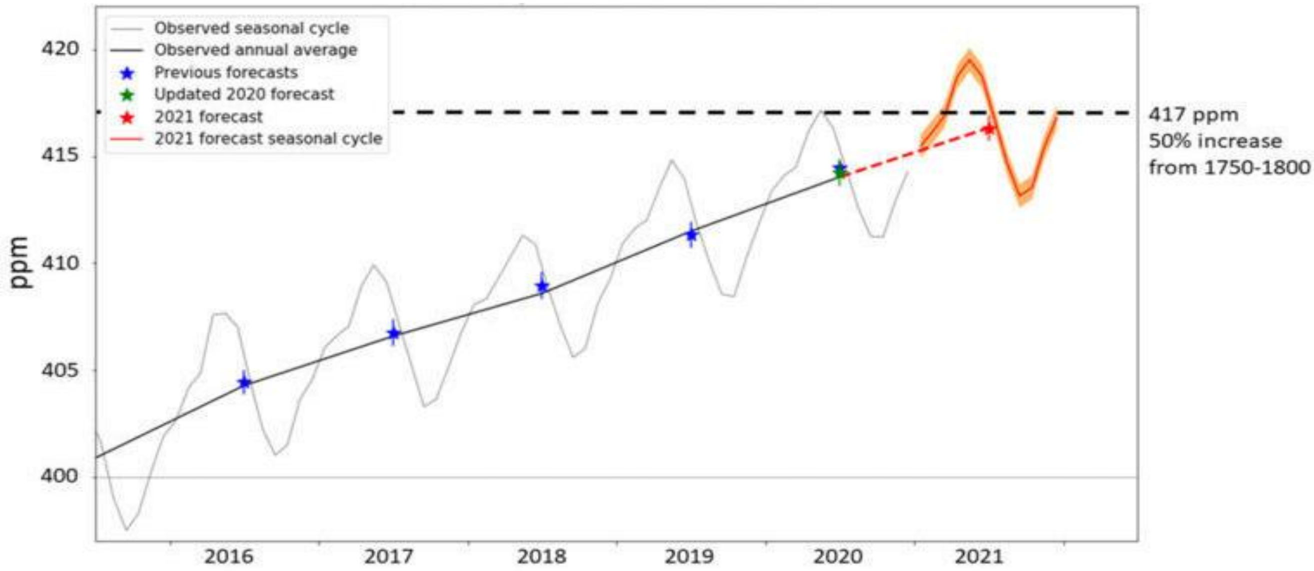

Fig. 1: Carbon Emissions cycle

(https://books.google.com.pk/books?hl=en&lr=&id=I4g0mlQI7HcC&oi=fnd&pg=PA1&dq=renewable+energy+and+economics&ots=IgoeBGErfi&sig=wxuOYSAolLafgIEcot-9TBxQSqw#v=onepage&q=renewable%20energy%20and%20economics&f=false)

The above graph is showing the annual cycle of atmospheric CO_2 level. Statistics are showing that global CO_2 decreased by 5.8% in 2020. This was the largest decline and almost five time higher than the 2009 global financial crises. CO_2 carbon dioxide is the primary greenhouse gas causing global warming. It acts like a blanket, trapping heat and results harmful activities such as stronger storms, sea level rise, drought, extinction and temperature rise. And most of these emissions come from burning of the fossil fuels (oil, natural gas, and coal) for energy and transportation. The combustion of gasoline and diesel in transportation sector was the largest source of carbon dioxide emissions in 2019, accounting for 35%, followed by the electricity sector with 31% and industry by 16%, while the combustion of fossil fuels for the residential and commercial use results 11 % of the Carbon dioxide emissions. Since the Industrial Revolution, human activities to achieve stable economic growth has contributed substantially to global warming and pollution because of emission of carbon dioxide and other heat trapping gases.

Along with risking human health, air pollution has caused a variety of environmental damages such as Acid rain, Eutrophication, haze, depletion of ozone, effects on wildlife, crop and forest damages, and most importantly global climate change. These acids are formed because of uncontrolled emission of deadly gases like nitrogen oxides and sulfur oxides when fossil fuels are burned to produce energy for domestic or industrial use. Carbon dioxide and methane commonly known as greenhouses gases caused damages to natural balance of Earth's temperature. And because of excessive emission of carbon dioxide Earth's average temperature is rising and this phenomenon is called global warming. To reduce emission of carbon dioxide and other deadly gases and elements, the world needs to shift towards low carbon sources of energy. Renewable energy sources are clean, safe, inexhaustible, and most importantly they are available everywhere. On the contrary, Fossil fuels such as oil, natural gas, and coal are available in finite quantities. And as we are keep extracting them, it might be possible they will run out sooner or later. Renewables differ from fossil fuels in terms of their diversity, potential, and abundance. And above them all they do not produce any of the deadly greenhouse gases nor polluting emissions.

The air and water pollution caused by the burning of fossil fuels such as oil natural gas and coal is linked with sever health problems such as neurological damage, heart attacks, cancer, breathing problems, premature deaths etc. Most of these deadly diseases are linked with air and water pollution that clean energy resources simply do not produce. Today, the global energy production system is dominated by fossil fuels but most of the major economies of the world are investing on renewables energy plants to overcome global warming and tackling with environmental issues. Renewable energy sources such as Wind, solar and hydroelectric energy systems produce electricity with zero air pollutions emissions. Geothermal and biomass energy system do emit little air pollutants but the ratio of air emissions caused by them is much lower than those of fossil fuel power plants.

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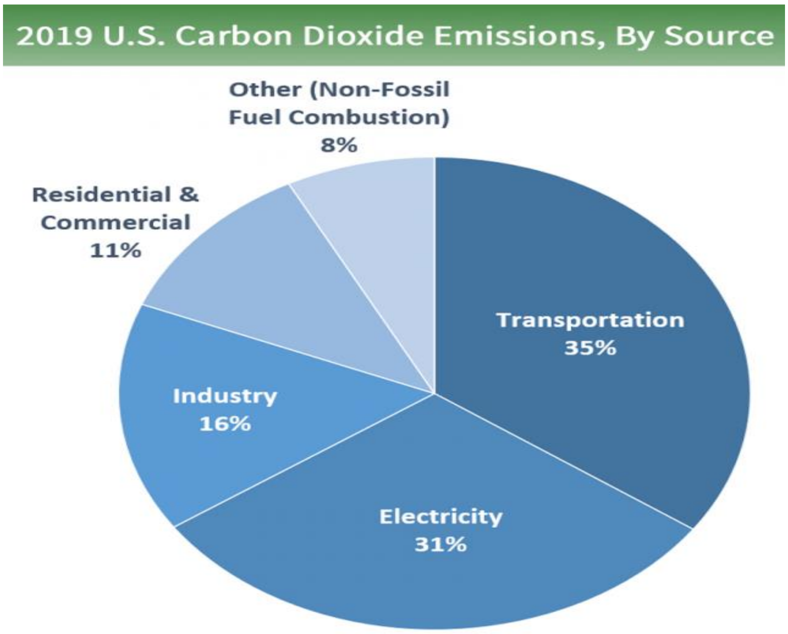

Fig 2: 2019 US carbom dioxde Emissions

In this chart we consider the death rates from energy production per terawatthour. One terawatt hour is equal to annual electricity consumption of about 187,000 citizens living in Europe. Markandya and Wilkinson et al. (2016) took an example to describe this term, like for example in a town of 187,090 residents, if electricity is generated from coal, we will expect that 25 people will die prematurely because of pollution caused by the burning of coal. And electricity is produced by the oil, pollution will cause 18 people to lose their life prematurely. And natural gas will cause three people to die. And if we see death rates associated with nuclear nobody will die in a year. It will take seven years before single person will die because of nuclear. And for the Wind, it will take 29 years, hydropower, it will take 42 years, and for the solar, it will take 53 years to cause a death. In addition, wind and solar energy plants require no water to operate and do not pollute any water resources. On the other hand, Geothermal and biomass power plants, oil, natural gas and coal-fired power plants require excessive amount of water for cooling down process.

Fossil fuel technologies are basically capital intensive and mechanized, while renewable energy industry is more labor intensive. Labor is required to install solar panels, and for the maintenance of wind forms technicians are required. This means that, electricity generated from renewable sources will create more jobs than of fossil fuels.

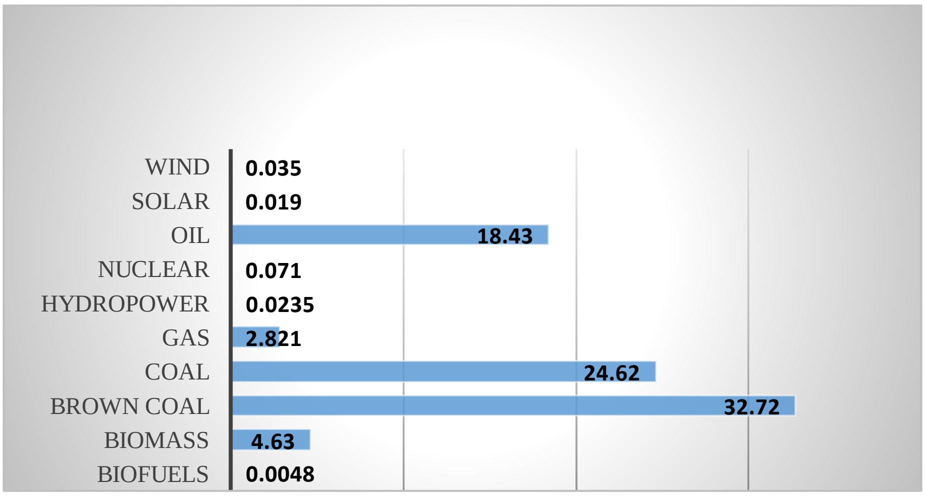

Fig. 3: Death rates from energy production per TWH

Source: MARKANDYA & WILKINSON; SOVACOOL ET AL. (2016)

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This graph depicts the number of people in millions employed worldwide in renewable energy. Which shows the consistent growth in numbers from 7.28 million employed people in renewable energy sector in 2012 to 12 million in 2020, reflecting a 4% increase than previous year. Increased support for clean energy will produce more jobs in the future. According to the International Renewable Energy Agency (IRENA), it has been seen 34 % growth in jobs in Renewable energy sector since 2013, adding additional three million jobs in world economy.

II. SHARE OF ELECTRICITY FROM RENEWABLES IN GERMANY

During the last few years, electricity generation from the renewable energy sources has seen a constant growth in the World because of global warming and pollution. Since 1990 energy coming from Renewables has been growing with an average 2% annually, but in the most recent years this growth rate is more than 5% on average. Germany has been often called as "the world's first major Renewable Energy Economy". Until 2014, Germany had the world's largest photovoltaic installed capacity. Germany has the highest installed wind capacity in Europe and third largest economy after China and United states of America.

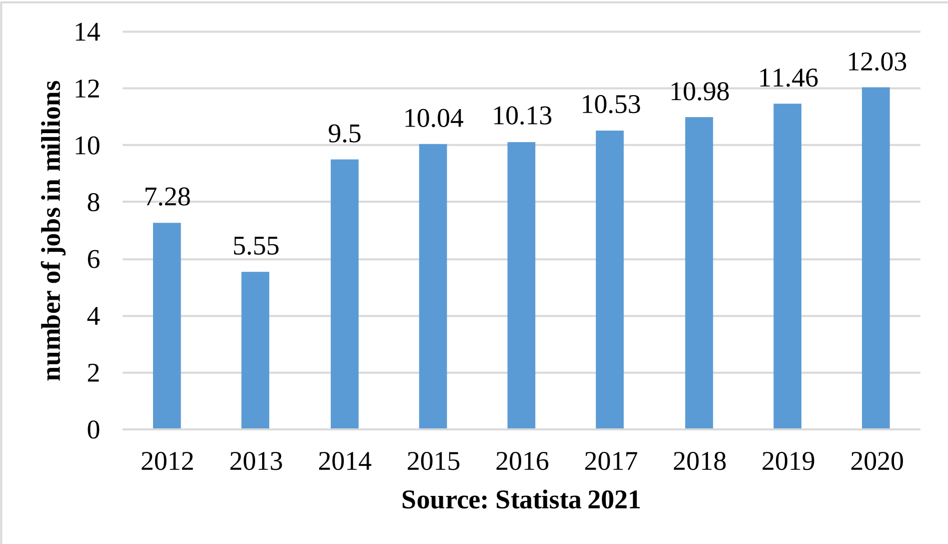

Fig. 4: People Employed in Renewable energy sector

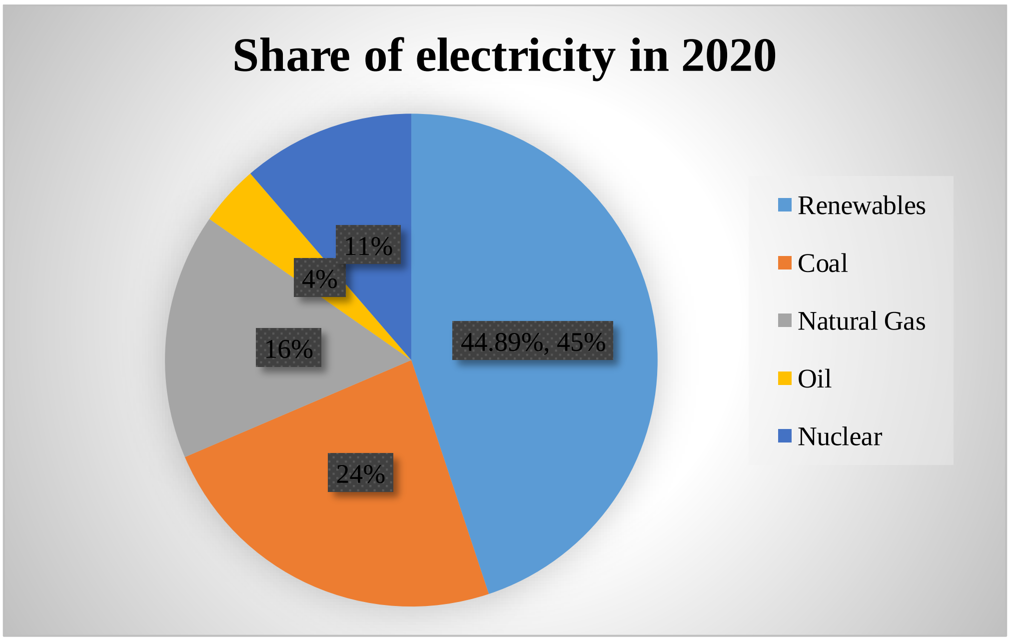

Fig. 5: Share of Electricity Production of all sources in Germany in 2020

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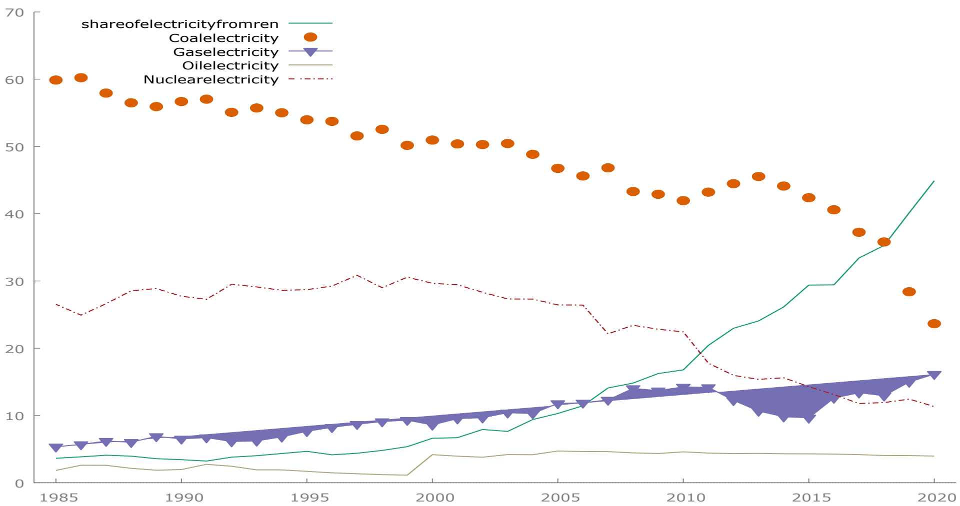

Fig. 6: Trends of Electricity Production of all sources in Germany (1985-2020)

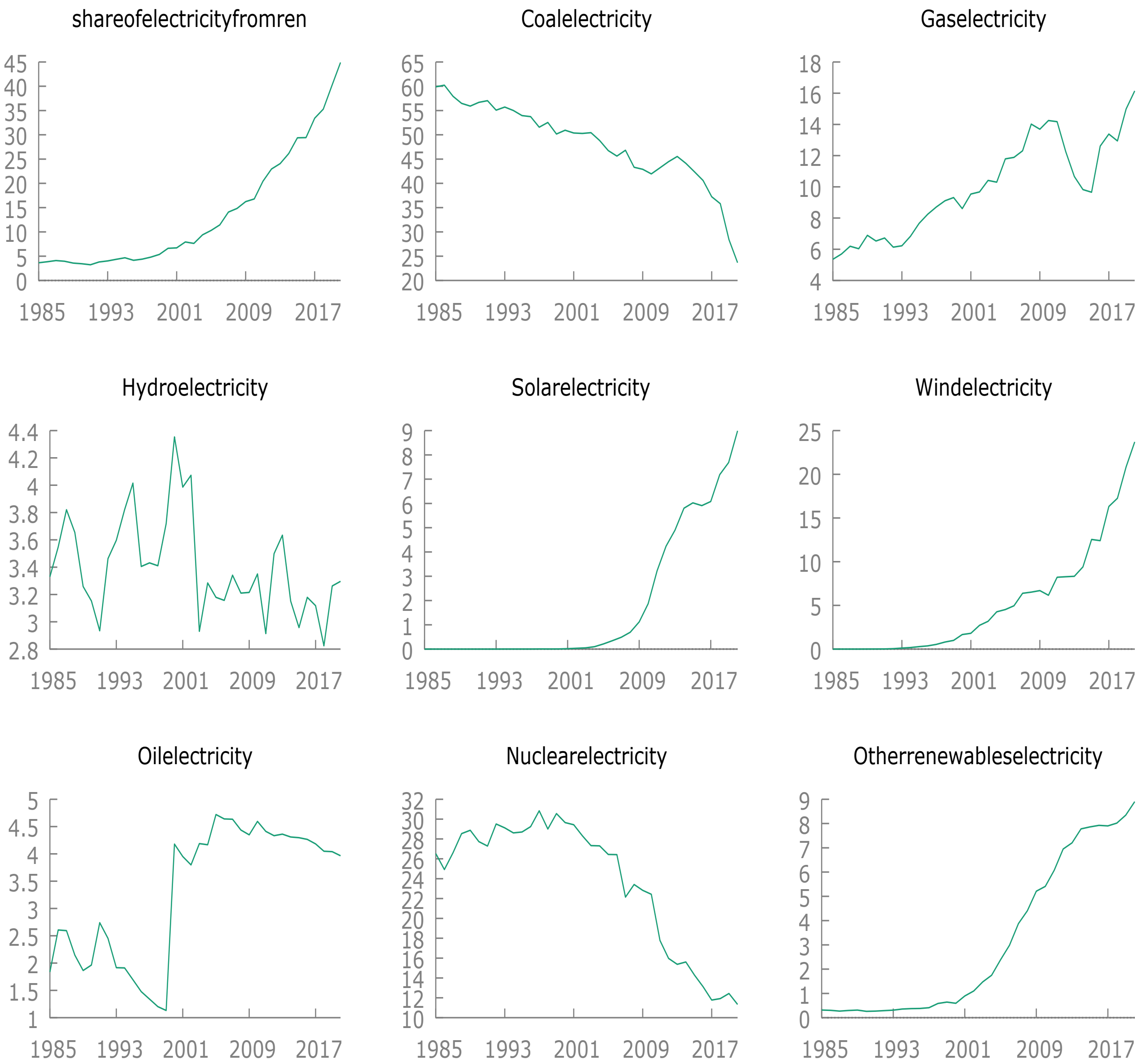

Fig. 7: Share of electricity consumption from all energy resources in Germany (1985-2020)

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The share of electricity consumption from renewable energy resources in Germany rose from 3.4% in 1990 to 10% in 2005 to 44 % in 2020. As with most of the countries are still struggling with the process of transition to Renewables either in transport or heating or cooling sectors. In 2020, renewables produced more electricity than fossil fuels like Coal, gas and oil and provided approximately 45 % of the total electricity demanded in Germany. plotting the graphs separately of all energy sources we can clearly see an upward trend in renewables (Wind, Solar, Biomass) and a downward trend in fossil fuels (coal, natural gas, and oil). Share of Electricity coming from the Nuclear technology is clearly decreasing from with 26.56% in 1985 to 11.3% in 2020. Share of wind and solar is particularly increasing rapidly from 0 % in 1985 to 27.2% and 10.5% simultaneously in the year 2020.

III. GLOBAL WARMING

Temperature is a primitive measurement when it comes to describe climate, and the continuously rising temperature in certain places have extensive effects on human life and ecosystem of the world. For instance, intensive heat waves because of higher air temperature can roots illness and deaths in extreme cases. Variations in temperature is disrupting a wide range of natural processes.

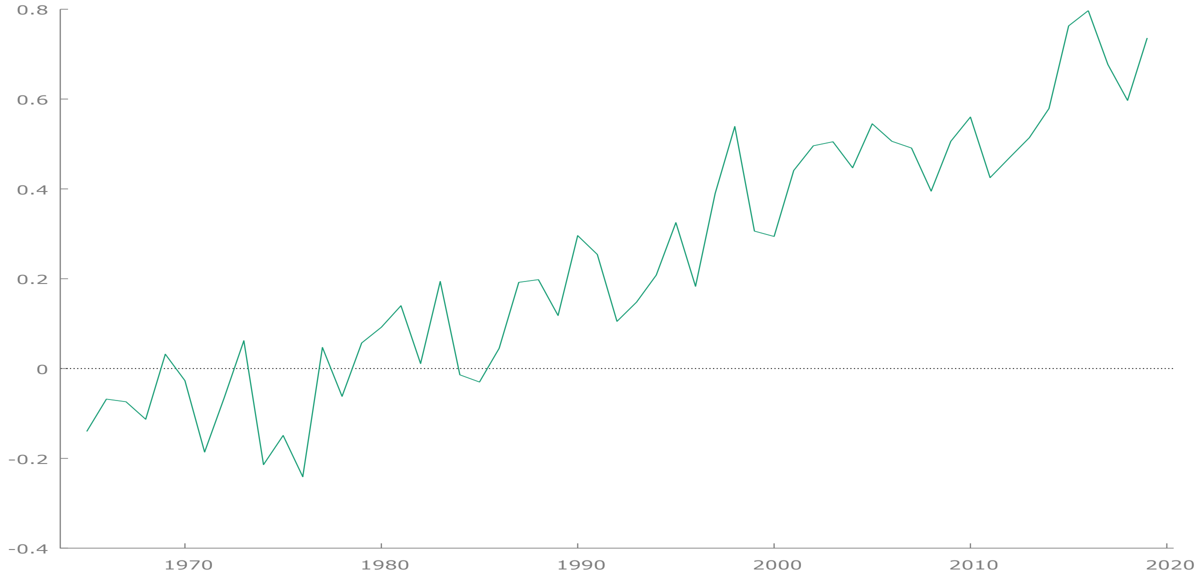

Fig. 8: Global rising temperature (1965-2020)

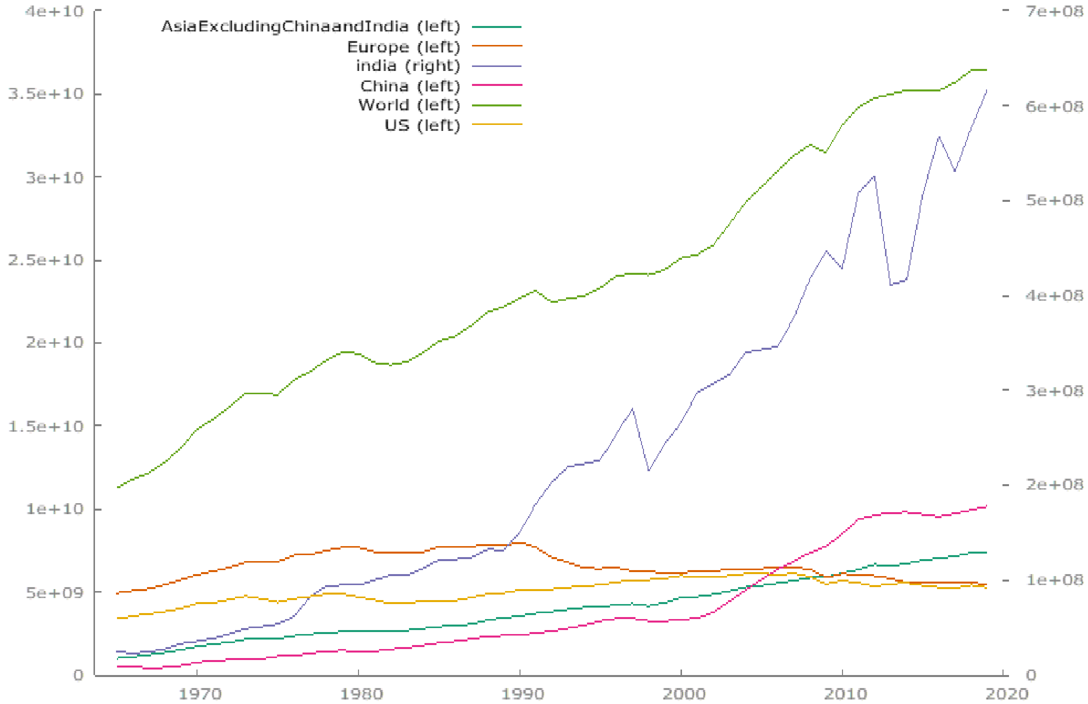

Fig. 8: Carbon emissions trends

The above mentioned graphs depicts the change in global temperature from 1965 to 2020. Since 2000 the world has seen the hottest 20 years. According to National Centers for Environmental Information (NOAA's) 2020 Annual climate Report, the combined ocean and land temperature has risen of 0.13 degrees Fahrenheit 0r 0.08 degrees Celsius per decade since 1880 and this rate has been twice since 1981 of 0.18°C / 0.32°F. Year 2020 was the second hottest year after 2007 in the last 141 years for the combined ocean and land surface. Many parts of the Europe and Asia had seen the record temperature particularly in Spain, France, Northern Portugal, Russia, most of the Scandinavian Peninsula, and southern China.

Since the Industrial Revolution, demand for energy has been increased enormously and to meet that demand the world was completely dependent on fossil fuels such as coal, oil and natural gas. And the result of this burning processes has significantly increased the emissions of Carbon dioxide and other greenhouse gases like methane etc., which has not only increased the world's temperature but also created multiple health related issues, Urban smog, and pollution. In the above mentioned graphs, we have discussed the Carbon dioxide emissions worldwide, there has been continuously increasing trends in Countries like China, India, Middle Eastern oil export countries.

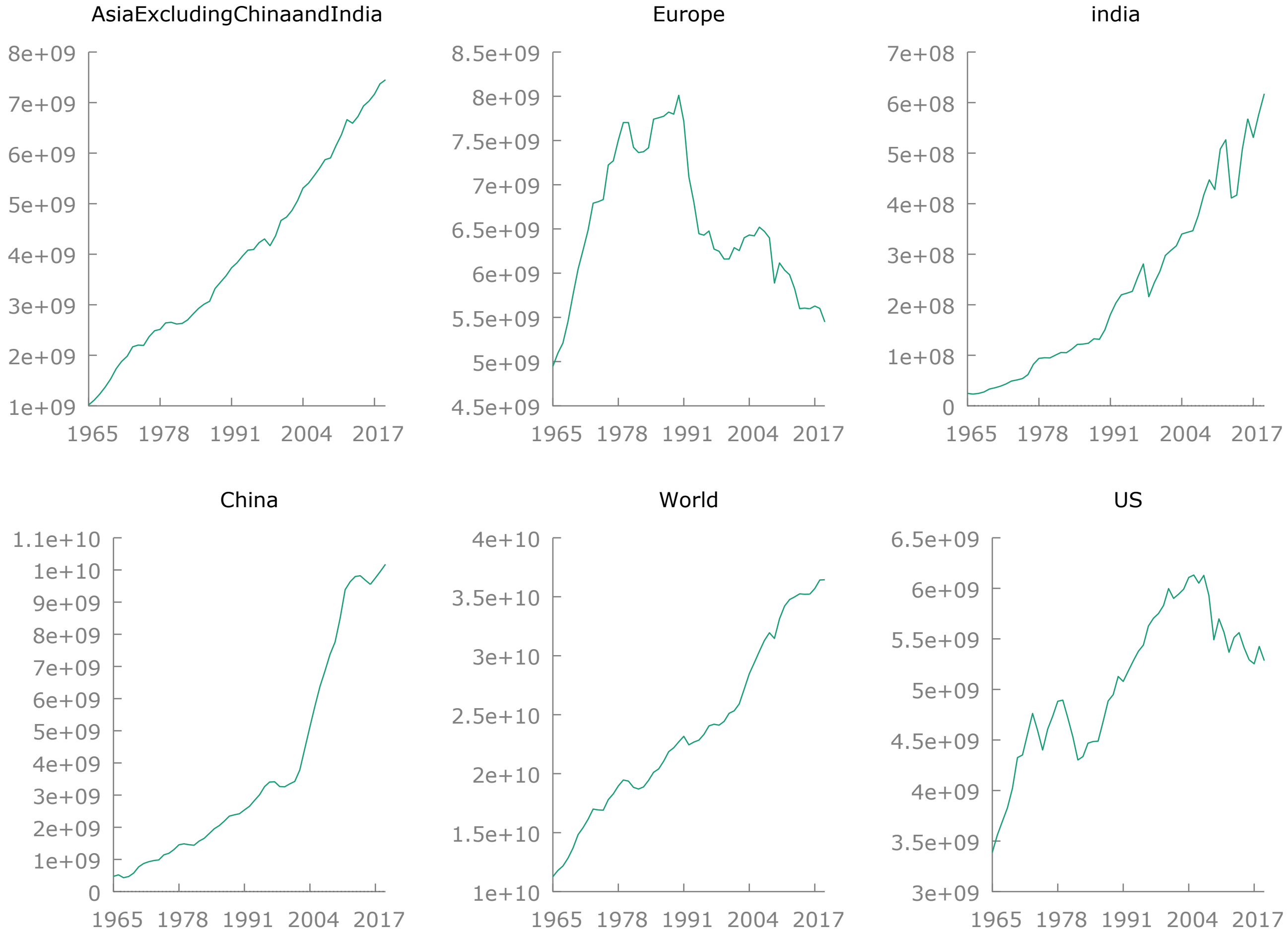

Fig. 9: Comparatively Analysis of Carbon Emissions

But we can clearly see downward trends in United States of America and European countries. For instance, Eastern European States joined EU regulations of Clean Energy and controlled carbon dioxide emissions and cleaned up their ineffective or inefficient infrastructure by declining independence on fossil fuels and relying on clean energy sources. Similarly, in US coal is being replaced by natural gas and renewables and emission of carbon dioxide is being controlled. On the other hand, situation in countries from Asia and Africa needs to do lot of homework to tackle this issue.

IV. LITERATURE REVIEW

Renewable energy and Global Challenges brings to focus of this research and the various challenges that are being faced by the resources of energy. There are many other important things in the current world where the use of renewable resources is experiencing some difficulties. This research will give a deep insight to us on the various aspects related to renewable energy resources and how they can be used to produce energy in the future. This research also meaning of renewable resources, the various biotic and abiotic resources and global warming effects.

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Quek&Ee et al, (2018) examined the sustainability by switching fossil based energy to renewable energy systems. The study used CML methodology and four major impacts were calculated as global warming potential (GWP), acidification of potential (AP), eutrophication potential (EP) and human toxicity potential (HTP). From A to Z analysis was conducted for various type of electricity supply sources like solar photovoltaics (PV), biogas, municipal waste incineration, natural gas, coal and oil. The findings of the study showed that electricity produced by solar PVs can produce 10x time higher HTP than baseline and similarly electricity produced by biogas eight time higher than AP and EP than baseline. So policies suggest that a mix of energy production (renewable and biogas) would be value based.

Zoundi Z. (2017) studied the short and long term effects of renewable energy resources on CO2 emission and the Kuznets Environmental Curve hypothesis for 25 selected African Countries. The findings of the study didn't provide significant or no evidences of total validation. Shockingly, CO2 emission showed significant relationship with income per capita. The research concluded that renewable energy had a negative impact on CO2 emission and this multiplies in the long run but remains efficient substitute for the conventional fossil fueled energy.

Moriarty P. &Honnery D (2019) explained the different forms of energies produced by renewable resources like biomass energy, hydroelectricity, wind energy, solar energy, and geothermal energy. According to them these five types of energies will remain dominant till 2050s. They concluded in their study that the future of RE each type depend on the factors availability like future land use, climate and other environmental changes. Further they stressed the effects of RE production on the environment.

Sadorsky P. (2008) explained that economic and social issues particular energy consumption and global warming raising greater need for renewable energy. The research employed an empirical model for renewable energy production for G7 countries. The findings of the study told that in the long run increased oil prices had negative impact on the renewable energy consumption whereas CO2 per capita appeared an important factor behind per capita renewable energy consumption. The short term shocks caused deviation from equilibrium and France took 1.3 years to correct it whereas Japan took 7.3 Years accordingly.

Qi T., Zhang X. &Karplus J. V (2014) found in their study that during 2010 to 2020 that current renewable electricity targets result in significant additional renewable energy installation and a reduction in CO2 emissions of 1.8%. The interesting thing was that the reduction in CO2 emissions because of increase in renewable relative to Policy baseline. This showed a very positive impact of renewables on both economic growth and technological cost after 2020. Taking in consideration the Policy or other factors, the cost of renewable energy decreased after 2020 and increased its share which later will result high economic growth through 2050. The research concluded at the end that in the long run the policy approach allowed flexibility to reduce CO2 emissions at lowest cost.

Chakravorty U., RoumassetJ. & TseK. (1997) presented a theory of resource extraction in their research that focused mainly on extraction for the resource in case of homogenous demand for it. As a matter of fact, the study explained the simultaneous extraction of different resources such as oil, coal, and natural gas and multiple demands such as trasportation, residential and commercial heating, and electricity generation. Through the multiple demand, grades and resources, the study estimated extraction cost, estimated reserves, and energy demand data for the world economy. The results showed that solar energy production will be much cheaper than the production of energy through oil or coal. Most probably the world will move from oil and natural gas use to solar energy. In this case, the Global temperatures will rise by only about 1.5–2 degrees centigrade and soon decline steadily to preindustrial levels. Further the research showed that the intergovernmental Panel study on Climate Change overstated about global warming.

Bloch H., Rafiq S. & Salim R. (2015) examined the relationship between Chinese aggregate production and consumption of three main energy resources: coal, oil and renewables. The study used ARDL and VWCM modeling technique and found significant impact of all three energy resources on Chinese growth. Further the research observed coal production negative impact on pollution while renewable energy reduced emissions. As for oil, no significant relationship on emission found. In the end, the study concluded that oil and renewable energy production appeared relatively cheaper than coal and this shift also led improvement in economic and environmental sustainability.

V. ECONOMETRIC MODE

$$y_t = \beta_0 + \beta_1 x_{1t} + \beta_2 x_{2t} + \beta_3 x_{3t} + \beta_4 x_{4t} + u_t$$

Where our dependent variable y_t is a share of the renewables in total electricity production in Germany and x_{1t} (price of oil per barrel), x_{2t} (price of Coal per ton), x_{3t} (average import price of Natural gas), and x_{4t} (Total Electricity production in Germany). we can re-write our Model

$$\begin{aligned} Shareofrenewables_t &= \beta_0 + \beta_1 oilprices_t + \beta_2 Coalprices_t \\ &+ \beta_3 gasprices_t + \beta_4 Totalele_t + u_t \end{aligned}$$

VI. METHODOLOGY AND DATA

In this study, I tried to see the impact of fossil fuel prices on electricity share coming from renewables. For this purpose, I used the time series data from year 1985 to 2020 from ESTAT and Federal Ministry for Economic affairs and Energy (BMWi) Germany. For the consumer price Index, I used FRED (Federal Reserve Economic Data). And for the global temperature and carbon emissions data sets I used Our World in data and BP statistical review of world energy. I used Gretlfor the stationarity check, plotting graphs and running regressions.

Using the data from 1985 to 2020, plotting the time series graph to check stationarity.

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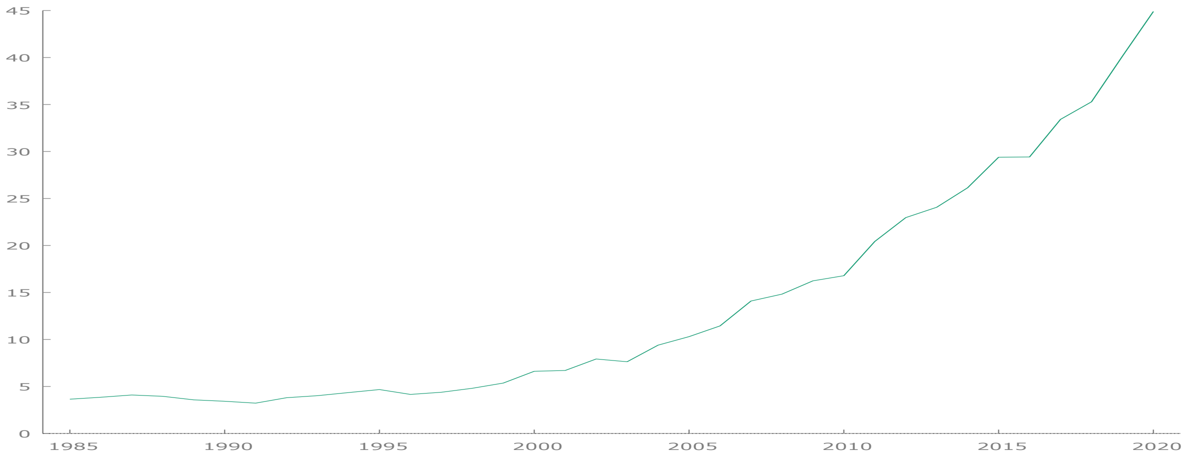

Fig. 10: Stationarity check of the data

This time series is showing exponential trend, which follows a series has the same average growth from period to period. This figure plots data on annul share of electricity from renewables during the years 1985 to 2020. In the early years we see that the change in annual growth is relatively smaller, but as time passes it increases. This is consistent with a constant average growth rate; the percentage change is roughly the same in each period. In practice, an exponential trend in a time series is captured by modeling the natural logarithm of the series as a linear trend.

$$\boldsymbol{logRenewshare_t = \beta_0 + \beta_1 logoilprices_t + \beta_2 logCoalprices_t + \beta_3 loggasprices_t + \beta_4 logTotalele_t + u_t}$$

Fig. 11: Taking the first difference of the data:

Checking for the Unitroot:

To check the unitroot I used Gretl. I can check stationarity in my dataset by using Gretl. The first difference of the natural log of each series in *varlist* is obtained and the result stored in a new series with the prefix ld_. Thus ldiff x y creates the new variables

ld_x = log(x) - log(x(-1))

ld_y = log(y) - log(y(-1))

running the command ldiff$Renewshare_t$, I got the new Variable ld_Renewshare

Now checking the UnitrootWith time,

adf 0 d_l_Renewshare -ctt

Dickey-Fuller test for d_l_Renewshare
sample size 34
unit-root null hypothesis: a = 1

test with constant
model: (1-L)y = b0 + (a-1)*y(-1) + e
estimated value of (a - 1): -0.967554
test statistic: tau_c(1) = -5.46005
p-value 7.154e-05
1st-order autocorrelation coeff. for e: -0.010

with constant and trend
model: (1-L)y = b0 + b1*t + (a-1)*y(-1) + e
estimated value of (a - 1): -1.12773
test statistic: tau_ct(1) = -6.35128
p-value 3.993e-05
1st-order autocorrelation coeff. for e: 0.011

adf 1 d_l_Renewshare -ctt

Augmented Dickey-Fuller test for d_l_Renewshare
including one lag of (1-L)d_l_Renewshare
sample size 33
unit-root null hypothesis: a = 1

test with constant
model: (1-L)y = b0 + (a-1)*y(-1) + ... + e
estimated value of (a - 1): -0.680218
test statistic: tau_c(1) = -2.76794
asymptotic p-value 3.164e-05
1st-order autocorrelation coeff. for e: 0.013

with constant and trend
model: (1-L)y = b0 + b1*t + (a-1)*y(-1) + ... + e
estimated value of (a - 1): -0.954696
test statistic: tau_ct(1) = -3.4966
asymptotic p-value 6.123e-05
1st-order autocorrelation coeff. for e: 0.012

Now we can clearly see the P-values ae very very small at every level so we can say that our series is stationary.

VII. RESULTS AND DISCUSSION

Model 1: OLS, using observations 1986-2020 (T = 35)

Dependent variable: dl Renewables electricity

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	0.0680770	0.0145641	4.674	<0.0001	***
lgasprice	−0.0591280	0.0833779	−0.7092	0.4837	
dlCoalPrice	0.371872	0.267359	1.391	0.1745	
dloilprice	0.0243972	0.0614978	0.3967	0.6944	
lElectorod	−0.556474	0.558681	−0.9960	0.3272	

Mean dependent var	0.071746	S.D. dependent var	0.083537
Sum squared resid	0.208443	S.E. of regression	0.083355
R-squared	0.121477	Adjusted R-squared	0.004341
F(4, 30)	1.037056	P-value(F)	0.404462
Log-likelihood	39.99730	Akaike criterion	−69.99461
Schwarz criterion	−62.21787	Hannan-Quinn	−67.31008
rho	0.020446	Durbin-Watson	1.954386

Now adding CO_2 emissions, and see,

OLS, using observations 1986-2019 (T = 34)

Dependent variable: ldRenewshare

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	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
lCoalprice	0.335407	0.306157	1.096	0.2823	
lgasprice	0.0382688	0.0998117	0.3834	0.7042	
loilprice	−0.00418498	0.0678447	−0.06168	0.9512	
lElectprod	1.67987	0.797008	2.108	0.0438	**
lCO2emissions	−2.65733	0.706571	−3.761	0.0008	***

Mean dependent var	0.070561	S.D. dependent var	0.084494
Sum squared resid	0.241220	S.E. of regression	0.091203
Uncentered R-squared	0.404217	Centered R-squared	-0.023870
F(5, 29)	3.935087	P-value(F)	0.007605
Log-likelihood	35.87903	Akaike criterion	−61.75806
Schwarz criterion	−54.12625	Hannan-Quinn	−59.15539
rho	0.011997	Durbin-Watson	1.945059

Numerical values of the coefficients indicate the quantity of impact on dependent variable and its sign tell us about the direction of relationship. T-statistics is used for deciding either impact that we have obtained is statistically significant or not. And p-value can also be used for the same purpose. If p-values are less than 0.05 then, we can say that the impact is statistically significant at 5% level of confidence. Its mean we are 95% confident about the occurring of the impact value. The results show that there is no significant relationship between prices of the fossil fuel (gas, coal, and oil) on the electricity production from renewables. Which means increasing prices of the crude oil, gas and coal have no direct link with the increasing share of electricity production from the renewable energy sources. But when we added global warming and Carbon emissions in the model, we have seen some level of significance in the results. Carbon emissions share significant results and negative relationship with Renewables. It means due to increasing carbon emissions and global warming, we are switching to renewable energy sources, as literature suggests that fossil fuels are one the biggest reasons of carbon emissions. Clean energy sources are the most valuable, desired and efficient energy sources when it comes to fight against pollution and safety for our planet.Dong et al. (2018), the authors showed that renewables energy decreases carbon emissions both in short term and long term and re-adoption leads to overall improvement in environment. Similarly, our results suggest the same results, adoption of clean energy sources will lead to improvement of environment.

Forecasting:

Model 6: OLS, using observations 1986-2020 (T = 35)

Dependent variable: Renewableselectricity

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	−0.138365	0.248280	−0.5573	0.5811	
Renewableselectricity_1	1.10370	0.0149425	73.86	<0.0001	***

Mean dependent var	13.87895	S.D. dependent var	12.03351
Sum squared resid	29.60090	S.E. of regression	0.947099
R-squared	0.993988	Adjusted R-squared	0.993805
F(1, 33)	5455.739	P-value(F)	3.12e-38
Log-likelihood	−46.73084	Akaike criterion	97.46169
Schwarz criterion	100.5724	Hannan-Quinn	98.53550
rho	−0.386550	Durbin's h	−2.295849

(0.248) (0.0149)

T = 35, R-squared = 0.994

(standard errors in parentheses)

Now we find the in sample forecasting first, we have to tell gretl using a subset of our data, particularly I will exclude last year data from the sample, by clicking sample and setting range to 2019, Gretl tells us full range and our sample too, let re running the model, ^Renewableselectricity = -0.0839 + 1.10*Renewableselectricity_1 (0.257) (0.0167)

T = 34, R-squared = 0.993

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Now let's see how much our model performs in forecasting the Renewable share in the next year, Going to Analytics For 95% confidence intervals, t(32, 0.025) = 2.037

Obs	Renewableselectricity	prediction	std. error	95% interval
2020	44.8969	43.9609	0.950561	(42.0247, 45.8972)

0

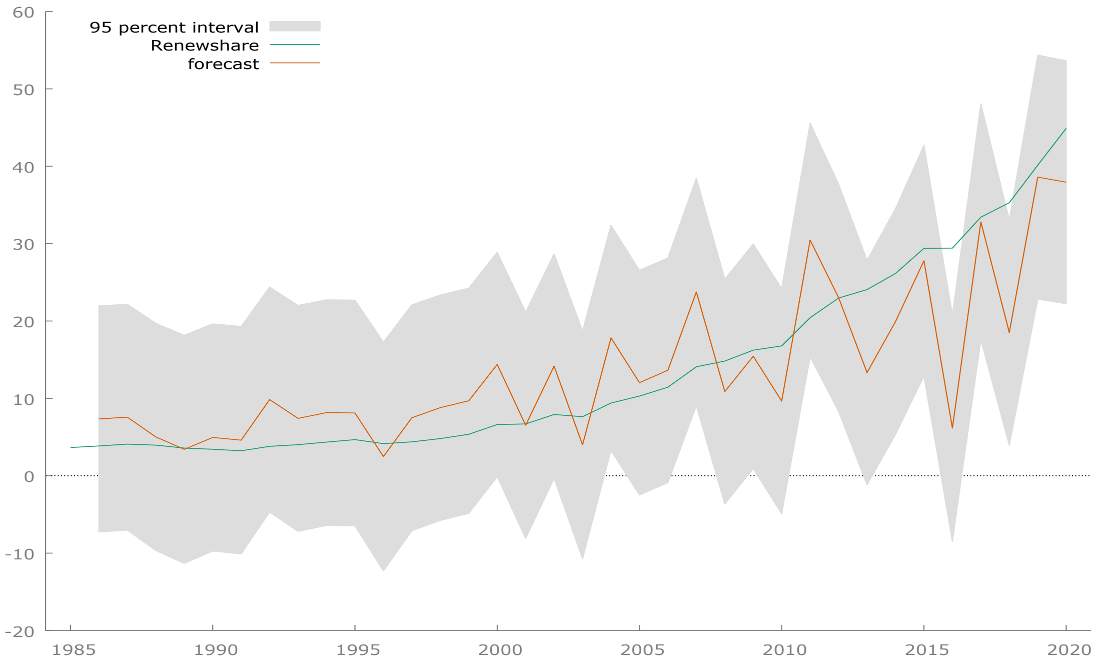

Fig. 12: difference between the forecasting and Actual data

The shaded area shows the 95% confidence interval, which means that our predicted value are within the 95% confidence interval line.

Forecasting for the next year,

by Restoring the full range and running the regression model and we must add variable in the data for the future forecasting, by just clicking add Observation,

^Renewshare = 5.96 + .78*Renewshare-1
(1.54) (0.825

T = 35, R-squared = 0.668

Renewableshare 2021 = 5.96 + 0.78*Renewshare-1

5.96 + 0.72* 44.89 = 40.97%

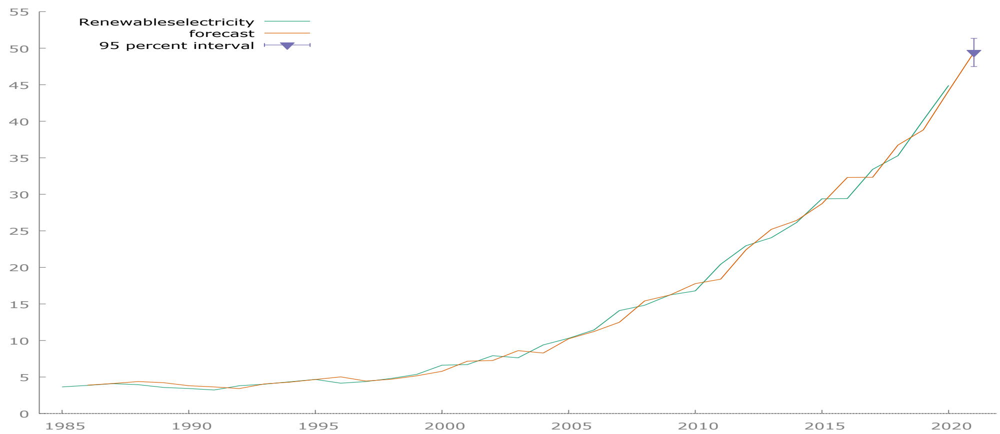

Fig. 13: Forecasting for the next year

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VIII. CONCLUSION

During the last few years, electricity generation from the renewable energy sources has seen a constant growth in the World because of global warming and pollution. Germany has been often called as "the world's first major Renewable Energy Economy". Until 2014, Germany had the world's largest photovoltaic installed capacity. Germany has the highest installed wind capacity in Europe and third largest economy after China and United states of America. This study checked the impact of fossil fuel prices on electricity share coming from renewables in Germany. The results show no significant results and concluded that prices of fossil fuels (oil, gas. Coal) are not primary reason of increasing share of electricity coming from the renewables but global warming does. Carbon emission shows stronger significant relationship with renewables. Which means increasing share of electricity production from the renewable energy sources is the only solution to deal with global warming, and carbon emissions.One of the most effective ways to reduce carbon dioxide emissions to the atmosphere is to deflate fossil fuel consumption. Multiple strategies are required for reducing Carbon dioxide emissions and instead of utilizing fossil fuels for energy renewable energy sources produce very little to zero greenhouse gases. The comparison between fossil fuels and renewable energy sources becomes clear when you see the numbers. Burning natural gas for the energy emits from 0.6-2 pounds of carbon dioxide (CO2E/kWh), while coal releases from1.4-3.6 pounds of (CO2E/kWh). On the other hand, Wind on a life cycle basis just releases 0.02-0.04 pounds of (CO2E/kWh), Solar 0.07-0.2, Geothermal 0.1-0.2, and hydroelectric releases 0.1-0.5 (CO2E/kWh).

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