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RESEARCH ARTICLE

Critical Analysis of Energy Consumption and Its Impact on Countries Economic Growth: An empirical analysis base on Countries income level

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Abstract
Energy is a very important and key factor for developing countries like China, India, and Pakistan have a growth rate of population is very high. In today's changing world scenario of Petroleum price high, that increasing the gap between demand and supply of energy in the World. Energy shortage is a test case for governments due to the high demand for energy due to rising commercial need, consumption, and industrialization. Current economic and energy crisis scenarios force me to work on those issues. An objective of the study is to test the long-run connection between energy consumption and economic progress from 1971 to 2021. This study adopts the Unit Root Test for stationary, Cointegrating equation and Vector Error Correction used for short-run/long-run relationship; Granger Causality test used for find-out the causal association, and Ordinary least square to examine the impact between energy sources and economic progress. The study result shows Oil, Gas and Electricity are equally important short run/long run, while the Coal log-run is more than in the short-run. The energy consumption to economic growth has a unidirectional causality, indicating energy is a factor that affects country growth. Regression results also confirm that energy significance on top for economic growth, Energy Sources; Gas and Electricity were useful but energy source Oil getting more attention in past decades. Currently, high-cost sources of energy, i.e. up Oil prices, this study suggest the alternate energy source nuclear, wind and solar to ensure low-cost energy generation to economic growth.

Keywords: Economic Growth, Resource of Energy, Energy Consumption, Causal Relationship.

Introduction

Research Background

Energy is a key element for a country and the main factor for the economy; the Energy field plays a critical role in Countries Growth, mostly the manufacturing sector. An optimistic long-run cointegrated association between actual Gross Domestic Product and energy consumption. There is no causality between short and long-run, unidirectional causality between energy consumption and economic growth. It shows energy utilization deduction does not affect G.D.P. in the short run but in the long run (C. C. Lee & C-P Chang, 2008). Compared to other World Pakistan has an inverse relationship in the technology sector. But in the United States, no association was found between energy utilization and gross domestic product, which effectively increased employment and economy. McKinnon and Shaw (1973) examine the relations among energy consumption and countries growth. Energy has to attain a high level of the central position of economic progress. Alam and But (2002), co-integration and unidirectional causality founded among the energy utilization and country growth.

Researchers disaggregate approaches used to establish economic growth affect energy sources, i.e. Oil, Natural Gas, Coal and Electricity. Oh, and Lee (2006) found the bidirectional causality between electricity and the gross domestic product of South Korea in the long run. Ghosh (2002), Mozumdar and Marathe (2006) described the gross domestic product causally influencing Electricity. Jamil, M. N. (2022) examined the 195 countries data to check the macro-economic stability period of 1961 to 2020 adopts new measurements under control of different income levels high, upper-middle, middle and lower-middle. Macro-economic stability examines through G.M.M. estimates per-capita G.D.P., G.D.P. growth, inflation and foreign trade. This study explores the Research further and estimates economic stability estimating through energy consumption. Yang (2000) and Fatai (2002) investigate the relationship between electricity and gross domestic product and analyze other factors like oil and coal and natural gas consumption. Currently, the World is facing the problem of energy shortfalls, and countries growth are reducing. Confusion is their energy have any impact on economies or not. It is more important to analyze the effect of energy on economic growth. This paper investigates the relations between energy consumption and economic growth

based on countries income levels, both in short/long periods of 1991 to 2021. Any associations found between energy utilization and economic growth than the government's steps to overcome those issues.

World Bank reports, national power policy announced by the Ministry support the current and future energy requirement and set a trajectory of rapid economic development. It also covers the energy sector's challenges and relieves the citizens. Following main goals have been set as policy.

- Increase the generation capacity, which is minimum to fulfil the country's energy demand.
- Ensure energy production through alternative energy sources, i.e. coal, wind, and nuclear at least units, start energy generation.
- Improve the transmission network distribution system and overcome line losses.

Energy System

Oil: The World is shifting pattern in the source of energy supply. The current scenario is mostly countries highly reliant on crude oil and natural gas, exposed to high risk and negative affect the economies. D. Mahmoudinia et al. (2013) found Unidirectional causality in the long run between oil and electricity consumption to the economy of countries; coefficient showing the negative effect on oil consumption and electricity usage on economic growth. Kamran Shafiq (2011) stated that imported fuel energy would affect the economy from the consequences of oil shocks. Oil price shocks have negatively impacted the growth of countries. Odhiambo (2010) Price rise led to falling in demand and causes of reducing the aggregate output and inversely affecting when price level decrease. The price of oil increased continuously1995 to onward. Ten dollars was per barrel (1995) and 110 dollars per barrel in 2014. During this time, low-income countries, i.e., Pakistan and the Indian economy, were seriously damaged and performed at a low level. Energy production estimates cost through oil I.P.P. thermal units Rs.18 and Rs.24 when produced through diesel. Pakistan economy declined in (2014) and grew in (2016) because the oil price is fast going down. January 2015 price of oil was at Rs.45 Dollars per barrel, helping Pakistan's economy, and it was performing well. The stock exchange crossed 34000 points in January 2015.

Gas: Pakistan domestic reserves of Natural Gas were 55.6 trillion cubic feet (June 30, 2013) and 30.9 trillion cubic feet of production. Investment (December 2013) was Rs.0.264 billion has made for L.P.G. Infrastructure and the total investment of this fiscal year near about 17.464 billion. Chinese investment (Road initiative) of this sector helped overcome the energy shortfalls.

Coal: Rohin Anhal (2013) has evidence in the association of unidirectional causality working from Coal consumption to economy. Coal share in energy generation was 6 per cent (1995). The government of Pakistan was working on coal units at Thor (Sindh) for energy and installing new units financed by China and World Bank. Thor Coal (Sindh) is the World most extensive resource of Coal. Pakistan and China were jointly working at Coal units of 6600 megawatts at Gaddani Power Park (Baluchistan).

Electricity: Oh and Lee (2006) find about bidirectional causality among Electricity and gross domestic product of South Korea in the long run. Yo and Choi (1985) found the cost of energy and electricity usage was a small proportion of the gross domestic product. In the World, energy generation through electricity is considered the secondary source. In contrast, primary generation energy by Coal, oil, gas, nuclear and other alternative natural resources is trending in most countries. Energy generation through electricity share in energy was 15.5 per cent (1995) and 13 per cent (2013). Imran and Siddiqui (2010) stated that Granger causality found Electricity to gross domestic product. In the short run, no causality relations were found from gross domestic product to Electricity or Electricity to gross domestic product. Still, in the long run, Electricity to economic progress causality exists, and high electricity usage tends to come with high gross domestic product. The previous study does not investigate the effect of energy on economic development. In this Research, we examine the following topics;

"Analysis of the total performance of the energy sector economically.

Analysis of the energy has an impact on economic growth or not. If yes, then what steps can take to increase the generation of energy and overcome the fallback on economic growth.

Suggest some points to plan, organize, lead, control, and get maximum Growth of Economies.

The World is energy lacking country, and the energy field works as bare capability. Gas distribution and transmission networks are the World biggest. If planning is not done, line losses increase, it may negatively affect economic development. It is the core issue, and my motivation is too high lights the issue and participate with good ideas to overcome the fallback on economies. The energy is significance profound. It works as blood for every country economic growth. The generation of

power is less than the demand. Causes of this; export of a country decreases due to Industry not meeting the production order timely and economy of countries go falls. All the time world needs to monitor progress, and the country continuously traces to energy to overcome the shortfalls of energy requirement. Early 90 Pakistan conducted strenuous efforts to reduce the rising demand and limited energy supply gap. The energy field (2000) get special attention because of its fast growth rate and energy demand. During 2011-12, Pakistan faces severe energy and gas shortages and study as a primary cause of unusual production activities in several manufacturing and industries. Pakistan energy industry saved off from 2019 to 2020, 0.2 % points of real gross domestic product growth. The power crisis cost to the economy is 380 billion rupees per year. It is near an estimation of 2% of gross domestic product. Govt. of Pakistan still subsides last four years, which round about 2.5 % of the gross domestic product of Pakistan.

The country needs to best plan, organize, and direct investment in infrastructure development. Current Govt. focusing on alternative energy sources produces natural gas, solar panel and wind. Countries determination is positive and govt. Received billions of rupees direct investment. The current year also progresses in economy and energy activities because of less loss of transformation line and energy distribution than last year. The gross domestic product and energy consumption of underdeveloping countries like Pakistanis are increasing exponentially. The main problem and solution will investigate; “There is a relationship between energy consumption and countries economic growth. It is cointegrated and overcomes the energy shortfall to enhance economic growth."

H1: Have a significant relationship with energy consumption to countries' economic growth.

Source of Energy: Net purchase of crude Oil in Pakistan in 2012 is near about 31% of the overall energy supply. S.D.P.I. report shows that crude oil and liquids manufacture in Pakistan has varied among 55000 to 70000 barrels per day since the 1990s. Pakistan produced 64000 barrels, refined oil capacity186000, and averaged near to 437000 barrels. Resource assessed Coal in Pakistan is over 185 billion tones and 175 billion find at Thar Pakistan Sindh area. Chinese power companies signed an agreement to install a 2400mw capacity coal project with the government of Pakistan, and work started on it. Pakistan production of Coal from 2008 to 2009 decreased by 17% and 10 % increase during 2009 and 10. Due to the import of Coal products being reduced, imported coal's share was around 62.2% in 2008 and 2009.

Current year its 67.9% count. Brick kilns industry usages were 39.6% in 2009 and 2010. Decline the coal share in energy and brick kilns sector in 2009 and 2010 2.4% and 35.8% respectively. The cement industry shifted oil to Coal because oil prices are higher than coal prices. Coal share decreased from 2007 to 2008 and 2009 mines production 15% and 4.12 million tones respectively. In 2012 natural gas Pakistan had a primary energy supply of 49 per cent, and dry natural gas production has grown by more than 80 per cent the last ten year by 809 and 1462 billion cubic feet in 2002 and 2012, respectively. Pakistan is facing shortfalls of natural Gas by the report of the Pakistan government near 912 Billion cubic feet in 2013. Pakistan does not have the proper infrastructure to import more Gas, and also domestic products also reduce time by time. E.I.A. reported the gas reserves of Pakistan to have 105 trillion cubic feet, and govt. It needs serious effort to avail that resource (Economic Survey of Pakistan).

Alternative energy source: Many alternate sources for energy and these purpose countries develop a responsible authority in the shape of an alternative energy development board. It deals with planning, constriction and facilitating services for the public and private sector. **Wind power projects:** The committee is working on four projects, three for 50 M.W. and one for 2.4 M.W. The Energy board provides technical support on 20 projects it’s a capacity of 50 M.W. each, which work in different places and participate in industrial development. A.E.D.B. signed an agreement with an international turbine manufacturer for technical support and equipment. One other company worked on 6 M.W. at the first stage, and then it installed 50 M.W.in the next phase. Paperwork is complete of 14 wind projects, and it was soon established. **Bio Diesel:** Alternative energy development board is working on biodiesel and has found many resources. Lab and experimental work started, and cultivation has risen from 2 and 650 acres in 2005 and 2009, respectively. Currently, in Karachi, a commercial biodiesel facility has been created, and its capacity of production is 18000 tons per year. **Bio-mass**: Alternative energy development board is working with the external organization for paperwork on the Biomass project in Karachi. Its first unit is a capacity of 10 M.W. and extends farther.

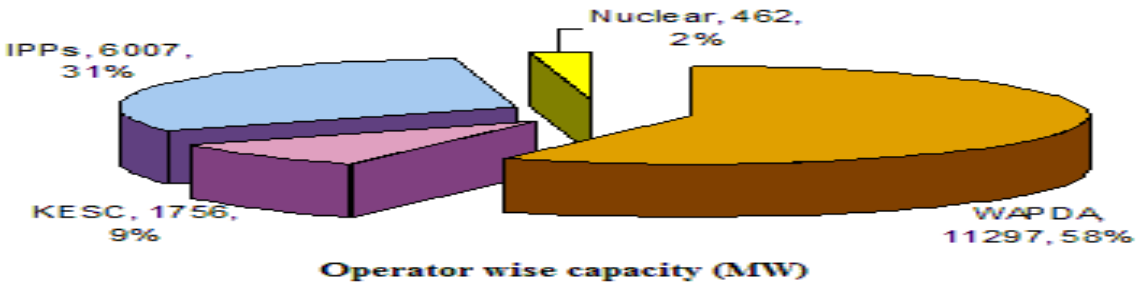
Canadian high-mark bio Gas Company signed an agreement with Punjab govt. For 22 M.W. capacity project construct at Punjab. **Hydro energy:** Govt. of Pakistan is taking with the Asian development bank on Diamer Basha Dam, and it is going positively. Chinese companies are working on the Neelam Jhelum hydropower project, and it started generation, and now company go for increasing capacity up to 969 MW and working started on it. A.E.D.B. is working on 103 micro-hydro projects, and it will complete in Chitral and Gilgit Baltistan areas. Govt. is working with the Asian

development bank on eight hydro projects for renewal. **Solar:** Chines firm ends a 100 MW solar park project at the Bahawalpur area of Punjab and further extends to 1000 MW.

The Punjab government facilitates water resorts, and tube wells will convert into solar panels.

Nuclear energy: P.A.E.C. is an autonomous body of energy production in Pakistan, and it is the main producer of nuclear energy. P.A.E.C.'s main responsibilities have to plan, establish the units, lead and control the atomic installation. The government of Pakistan has approved four projects of 3511 MW nuclear energy project will complete under the assistant of china govt. Currently, Pakistan has two nuclear installations in Karachi, which is at Chashma. One more plan installation is under construction at Chashma, a water pressure type reactor installed in 2000, and its generation capacity is 325 and 2063.94 in 2009 and 10. It operates commercially. The name of the energy unit is c-1. Pakistan also installed a c-2 nuclear energy plan in 2011 and now working on c-3 and c-4 plants. P.A.E. sign task for installation of 8800 MW nuclear power before 2030. That's why systematic services and resources have been arranged and working on it. K-1 project is working on 1100 MW, and k-2 also has the same capacity.

Figure 1. Operator wise capacity (MW)



Literature Review

Assessments of Relatives' Studies:

Granger and Engle (1987) measure the causality relationship between energy consumption and the economic progress of a country. It also works on fuel and electricity issues. Empirical studies applied different techniques in different conditions. Results also show different country by country, condition of the environment, the requirement of energy and sources of energy production. Kraft (1978) stated that Electricity has significance for economic progress. Integration found among energy utilization and G.D.P. for economy result by unidirectional relations. Yu & Choi (1984) examine the standard causality test period of 1954 to 1981 relationship among gross national product and different sources of energy usage with panel group of countries. Unidirectional causality ran among energy utilization and gross domestic product of Korea Philippines; no causality exists in the U.S.A., U.K. and Poland. Masih (1996) was found the causality working energy usage to gross domestic product. Unidirectional causality exists in Pakistan, India, and Indonesia, but non-co-integration in Malaysia, Singapore, and the Philippines. The same data applied the vector error correction model and found bidirectional causality between energy utilization and Pakistan growth. Unidirectional causality was found in India and Indonesia. This study was also applied by non-co-integrated countries (including Malaysia, Philippines and Singapore), but no Granger causality was found. Pachauri and Filippini (2004) examine the variables, and the result shows if population and industrialization increase, the main reason for the increase of energy utilization. Lee (2005) was analysis the co-integration and causality relationship among energy utilization and gross domestic product in eighteen developing countries by using data period of 1975 to 2001. It also compares data through Unit root test, heterogeneous panel co-integration and panel E.C.M. model. There was evidence of the short-run/long-run causality relationship between energy consumption and gross domestic product. These results propose energy conservation policies capacity, to which extent, and damage economic growth in developing countries. Francis (2007) examines the causality between energy and gross domestic product by multivariate Bayesian V.A.R. Bayesian techniques. Jamil, M. N. (2022) use data of seven world countries period of 1955 to 2021 and estimates the impact of exchange rate and prices on countries policy. This study will further explore and examine the energy impact on

countries growth. Qureshi and Sahir (2007) define; energy as a lifeline of a country's economy. It is an important resource of socio-economic progress and deliberate commodities. Later on, Riaz and Adnan (2008) studied estimated and found unidirectional relationships in the long period and bidirectional in the short period. Both persons study conduct and conclude that energy affects the whole growth of countries and go other jobless environment and social issues rise (2011). Li et al. (2011) analyzed data from china 30 provinces from 1985 to 2007. Examine the causality relations between CO2 emissions, energy usage, and China's economy. The final result of their paper was unidirectional causality relations among gross domestic product and energy consumption. It has positive long-run cointegrated relations; if per capita gross domestic product increase by 1 per cent, energy usage will increase by 0.50 per cent approximately. Rejeb and Farhani (2012) stated that no causality was found in short-run energy consumption to the economic growth of 15 MENA countries. As well as, unidirectional causality was working energy usage to the economy of 15 MENA countries. A.Y. Javid et al. (2013) conducted a study and Analysis; Pakistan is working at bare competency in the energy sector, planning and direct investment required for this sector; if Pakistan goes the other way, it harms the economy of Pakistan. Finding to Muhammad et al. (2013), the relationship between energy usage and the country's economy is empirical. The study analyzed the data from 1980 to 2009. It concluded that developing country like Pakistan has less economic growth due to the shortfall of energy, and the distribution structure was very poor. Fulfilling demand and constant supply of energy are important for the healthy Industry and growth of a country. Arslan et al. (2013) was Analysis the heterogeneous panel data from 47 U.S. states and examined the relations between energy consumption to an economic period of 1997 to 2009. Bidirectional causality relations found among energy consumption and economic progress. Many studies had completed on energy utilization and the economy of countries. Different researchers applied different techniques for investigating energy and economic relations, but unfortunately, no consensus developed. Every country has a different scenario and results also differ Fatai (, 2010). Ozturk (2010) stated that different countries different studies have done on energy utilization and gross domestic product relations. However, still mixed evidence were empirical researches and controversial direction in terms of causality. The intensity of the effect on energy policy is important. A study on energy consumption and economic growth conducted by A. Salman et al. (2013) are Analysis the data from 1978 to 2012. This study concluded that energy consumption significantly affects the gross domestic product in the short run, and unidirectional causality is found in the long run. Energy is a harmful factor for the economy, and it increases production, which leads to more investment and more jobs for people. Different income level countries have different environments and scenarios in word. It was a gap in the direction of causality between energy consumption and economic growth. A. Salman et al. (2013) study also did not tackle that issue. So I overcame the Gap through my Research by using different countries' income levels.

Research Methodology

Data collection and Model: Study analysis relationship of energy usage and countries economic development for 1971 to 2021. This paper uses time series secondary data Gross Domestic Product (G.D.P.) four-level of income; High income, upper middle income, middle income, lower middle income and energy consumption of Oil, Gas, Electricity and Coal. Data collected by World Bank and I.M.F. For defining each variable in all four High income, upper middle income, middle income, lower-middle-income sample units were selected. Two variables were used (1) Gross domestic product (four income levels of countries) as a dependent variable which presents as country economic growth. (2) Energy consumption of Oil, Gas, Electricity and Coal as an independent variable. Last two decades, different methods were used to analyze the long-run co-integration between time series variables and were mostly used in empirical research. An example of Engle and Granger (1987) was univariate co-integration recommended. For Integration, the variable requirement augmented Dickey-Fuller unit root test applied. Commonly, the variable is known as integrated of order d and written by *I*(d). The integrated order of variable was more significant than or equal to 1 is non-stationary. Asteriou and Hall (2007) state that economic variables cointegrated in order 1. After that stage, if I find evidence of co-integration among variables, I need the Granger test for Analysis. (X) Time series is said to Granger cause and on the other hand time serious (Y). The prediction error of Y was a decline by using the past values of X in addition to past values of Y. Inversely, Y to X was defined as the same. The empirical result will be found in granger causality in at least one direction (X to Y), (Y to X).

Regression equation (X on Y) is

$$(X - X^{-}) = r.\ \frac{\sigma x}{\sigma y}\ (Y - Y^{-})$$

Regression equation (X on Y)

$$(Y - Y^{-}) = r.\ \sigma x\ (X - X^{-})$$

σy

The Gross Domestic Product (G.D.P.) has been taken as dependent variables which present the Economic Growth of Countries and energy consumption, i.e. Oil, Gas, Electricity, and Coal is taken as the independent variable. The time-series data have the unit root problem and mostly presents the non-stationary tendency. So Augmented Dickey-Fuller test is used to make the data stationary. The causality test is used to determine the causal relationship between energy and G.D.P. Gross domestic Growth and The Energy Consumption Annual Growth. Finally, the Ordinary least squares model was applied to examine the impact of energy consumption i. e. Coal, Gas, Electricity and Oil impact income level countries groups, i.e. High income, upper middle income, middle income, and lower middle income.

Data Analysis and Finding

Table 1. Descriptive Statistic

Variable	Mean	Median	Maximum	Minimum	Std. Dev.
COAL	5593.36	3364.00	25300.00	1065.00	5508.26
GAS	712852.3	590333.5	1454697.0	11514.0	452776.70
ELECTRICITY	456951.12	424190.00	1120700.00	53332.00	316607.23
OIL_PETROLEUM	1267045.0	1426707.0	2556125.0	278246.0	667502.0

The above table shows the descriptive statistic comparison of Coal, Electricity, Gas and Oil for 1991 to 2021. Results show Oil Petroleum mean 12671045 and standard deviation 6675020 are highest compared to other energy source variables, which means it's a more critical and high volume of impacting of the energy source of share. Energy source Gas on 2nd place important according to the volume of the impact of the energy source of share. Electricity shares in energy generation on 3rd and Coal shares in energy generation on fourth place. Oil is getting more attraction and leading energy sources than other energy sources.

Table 2. Unit Root Test

Unit Root Test		**Coal**	**ELECTRICITY**	**GAS**	**Oil**
Augmented Dickey Fuller test statistic (Level)		t-Statistic 3.6769	t-Statistic 0.6456	t-Statistic -1.8465	t-Statistic -1.6004
Test critical values:	1% level	-3.6105	-3.5885	-3.5744	-3.5744
	5% level	-2.9390	-2.9297	-2.9238	-2.9238
	10% level	-2.6079	-2.6031	-2.5999	-2.5999
Augmented Dickey Fuller test statistic (First Diff.)		-5.5701***	-4.0361***	-0.6348*	-4.2745***
Test critical values:	1% level	-3.5925	-3.588509	-3.574446	-3.5744
	5% level	-2.9314	-2.929734	-2.923780	-2.9238
	10% level	-2.6039	-2.603064	-2.599925	-2.5999

The above table shows the trend and stationary level according to 01%***, 05%**, 10%*; Level, 1st difference level. Coal 3.6769 at the level and first difference at -5.5701*** showing 1% stationary. Electricity 0.6456 at the level and first difference at -4.0361*** assigning 1% stationary. Gas -1.8465 at the level and first level at -0.6348* showing 10% on stationery, Oil -1.6004 at the level and -4.2745*** first difference 1% on stationary found. So, data is the perfect stationary use for further analysis of data.

Table3 . Cointegrating equation

Dependent	tau-statistic	Prob.*	z-statistic	Prob*	Rho - 1	Rho S.E.	Residual variance	Long-run residual variance
COAL	-4.27	0.84	-27.17	0.84	-0.55	0.13	977465.40	977465.40
ELECTRICITY	-4.89	0.61	-32.73	0.60	-0.67	0.14	3933533.00	3933533.00
GAS	-6.36	0.12	-90.69	0.00	-1.11	0.17	1760000000.00	5090000000.00
Oil Petroleum	-4.59	0.74	-30.02	0.73	-0.61	0.13	1130000000000.0	1130000000000.0

Automatic lags specification based on Schwarz criterion (max lag=10)* Co integrating equation deterministic: C MacKinnon (1996) p-values. The above table shows the Johansen Co-integration test results; Residual variance showing the short-run relationship, and Long-run residual variance showing the long-run relationship. Oil at 1130000000000 short-run and long-run residual variance of oil are 1130000000000 at same level mean oil is the equal impact on an economical short run as well as long run. Gas 1760000000 short run and 5090000000 for a long run almost 1:3 ratio impacts economies but as compared to oil is minor impact source of energy on the economic growth of countries. Electricity is at 3933533 in the short-run and 3933533 in the long run. This means electricity also has the same impact as oil; the short-run equally impact the long-run ratio but less Oil and Gas. Coal is at 977465 for both short-run and long-run effects on economies from 1971 to 2021.

Table 4. Vector Error Correction Estimates

Co integrating Eq:	CointEq1
COAL(-1)	1.000000
GAS(-1)	0.002136
	(0.00200)
	[1.06885]
OIL(-1)	0.000393
	(8.2E-05)
	[4.80676]
ELECTRICITY(-1)	-0.226915
	(0.04771)
	[-4.75596]
C	-1577.864

Table 5. Error Correction

Error Correction:	D(COAL)	D(GAS)	D(OIL)	D(ELECTRICITY)
CointEq1	-0.412593	-24.88258	-435.4846	-2.585899
	(0.33878)	(10.1968)	(217.174)	(0.73028)
	[-1.21786]	[-2.44023]	[-2.00524]	[-3.54095]
D(COAL(-1))	0.288043	14.65094	-511.2334	1.712774
	(0.44831)	(13.4935)	(287.386)	(0.96639)
	[0.64250]	[1.08578]	[-1.77891]	[1.77235]
D(COAL(-2))	0.474045	-8.983501	499.2669	1.369295
	(0.33694)	(10.1413)	(215.992)	(0.72631)
	[1.40691]	[-0.88583]	[2.31151]	[1.88528]
D(GAS(-1))	0.003361	0.466280	3.210511	0.020504
	(0.00575)	(0.17317)	(3.68817)	(0.01240)
	[0.58425]	[2.69265]	[0.87049]	[1.65329]
D(GAS(-2))	0.004882	0.346989	-5.993066	0.045461
	(0.00653)	(0.19646)	(4.18420)	(0.01407)
	[0.74788]	[1.76622]	[-1.43231]	[3.23104]
D(OIL(-1))	4.78E-05	-0.000976	0.246846	0.000310
	(0.00022)	(0.00654)	(0.13927)	(0.00047)
	[0.22000]	[-0.14927]	[1.77239]	[0.66234]
D(OIL(-2))	0.000316	0.008052	-0.036788	0.001366
	(0.00018)	(0.00547)	(0.11653)	(0.00039)
	[1.74002]	[1.47171]	[-0.31570]	[3.48686]
D(ELECTRICITY(-1))	0.203423	-4.631021	-40.63814	-0.423038
	(0.13114)	(3.94707)	(84.0656)	(0.28268)
	[1.55119]	[-1.17328]	[-0.48341]	[-1.49650]
D(ELECTRICITY(-2))	0.034975	2.037462	126.6926	-0.211360
	(0.13537)	(4.07430)	(86.7752)	(0.29180)

	[0.25837]	[0.50008]	[1.46001]	[-0.72434]
C	-817.9280	-2743.056	128513.1	-767.2301
	(332.325)	(10002.4)	(213033.)	(716.359)
	[-2.46123]	[-0.27424]	[0.60325]	[-1.07101]
R-squared	0.501926	0.746871	0.732920	0.769056
Adj. R-squared	0.380773	0.685299	0.667954	0.712880
Sum sq. resids	54747946	4.96E+10	2.25E+13	2.54E+08
S.E. equation	1216.419	36612.02	779770.3	2622.110
F-statistic	4.142902	12.13005	11.28168	13.69022
Log-likelihood	-394.9405	-554.9504	-698.7057	-431.0397
Akaike AIC	17.23151	24.04044	30.15769	18.76765
Schwarz SC	17.62516	24.43409	30.55134	19.16130
Mean dependent	419.8936	19146.38	247172.1	1666.894
S.D. dependent	1545.817	65264.13	1353218.	4893.500
Determinant resid covariance (of adj.)		2.64E+33		
Determinant resid covariance		1.02E+33		
Log-likelihood		-2052.776		
Akaike information criterion		89.22451		
Schwarz criterion		90.95656		

The above table shows Vector Error Correction Estimates of Coal, Electricity, Gas and Oil, which show the short-run and long-run behavior for the economy, energy behavior for countries growth; Co integrating Eq; Coal (-1) at 1.000000, Gas (-1) at 0.002136, Oil (-1) at 0.000393 and electricity (-1) at -0.226915 showing the long run behavior of energy consumption for economic growth of countries. Coal, Gas and Oil are the positive behavior and electricity showing negative behavior for countries' economic growth. As d(coal(-1)), d(gas(-1)), d(oil(-1)), d(electricity(-1)) and d(coal(-2)), d(gas(-2)), d(oil(-2)), d(electricity(-2)) are showing short run energy impact on countries growth.

Table 6. Granger Causality Test

Pairwise Granger Causality Tests (Lags: 2)

Null Hypothesis:	Obs	F-Statistic	Prob.
high income does not granger cause Coal	48	0.24640	0.7827
coal does not granger cause high income		11.9124	8.E-05
upper middle income does not granger cause Coal	48	0.09245	0.9119
coal does not granger cause upper middle income		0.72230	0.4914
middle income does not granger cause Coal	48	0.08478	0.9189
coal does not granger cause middle income		1.52036	0.2302
low, middle income does not granger cause Coal	48	0.67534	0.5143
coal does not granger cause low middle income		1.64604	0.2047
high income does not granger cause Gas	48	2.28579	0.1139
Gas does not granger cause high income		10.3377	0.0002
upper middle income does not granger cause Gas	48	0.45125	0.6398
Gas does not granger cause upper middle income		3.22867	0.0494
middle income does not granger cause Gas	48	0.54659	0.5829
Gas does not granger cause middle income		4.77533	0.0134
low middle income does not granger cause Gas	48	0.22268	0.8013
Gas does not granger cause low middle income		3.79877	0.0303
high income does not granger cause Oil	48	0.00954	0.9905
Oil does not granger cause high income		2.67406	0.0804
upper middle income does not granger cause Oil	48	0.62910	0.5379
Oil does not granger cause upper middle income		0.29675	0.7447
middle income does not granger cause Oil	48	0.59166	0.5578
Oil does not granger cause middle income		0.55671	0.5772
low middle income does not granger cause Oil	48	0.00800	0.9920
Oil does not granger cause low middle income		0.82507	0.4450

high income does not granger cause Electricity	48	0.13992	0.8698
electricity does not granger cause high income		9.29554	0.0004
upper middle income does not granger cause Electricity	48	0.05133	0.9500
electricity does not granger cause upper middle income		2.05115	0.1410
middle income does not granger cause Electricity	48	0.08507	0.9186
electricity does not granger cause middle income		2.52215	0.0921
low middle income does not granger cause Electricity	48	0.40355	0.6704
electricity does not granger cause low middle income		0.32347	0.7254

The above table shows the Causal relationship structure between Countries economic growth and energy consumption through the Granger Causality approach. The Granger causality approach is used to test whether the above variables are useful for forecasting another. Where the probability value is less than any significance level, we cannot reject the hypothesis and accept it at that level. That value is above the significant level; we can reject the hypothesis. Gas does not granger cause high income at 0.0002; Gas does not granger cause upper middle income at 0.0494; Gas does not granger cause middle income at 0.0134; Gas does not granger cause low middle income at 0.0303; Oil does not granger cause high income at 0.0804; Electricity does not granger cause high income at 0.0004 and Electricity does not granger cause middle income at 0.0921; we can accept hypothesis because p-value under the significant level 1%, 5% and 10%; accept at his own level of significant. All other variables can reject; their p values are above the considerable level. The unidirectional causality found among energy consumptions to countries growth economies.

Table 7. Regression

variable	High Income	Upper Middle Income	Middle Income	Lower Middle Income
GDP				
COAL	0.04** 2.11	0.06*** 3.12	0.05*** 2.85	0.01 1.81
ELECTRICITY	-0.02*** -3.03	-0.04*** -4.88	-0.04*** -4.76	-0.01*** -2.79
GAS	5.80* 1.68	2.08*** 5.36	1.82*** 5.35	0.01*** 3.36
OIL	6.31*** 4.37	6.36*** 3.91	5.69*** 3.99	0.01*** 2.92
R-squared	-0.26	-0.18	-0.17	-0.04
Adjusted R-sq.	-0.34	-0.26	-0.25	-0.11
S.E.S.E.S.E. of regression	2.20	2.48	2.17	2.29
S.D.S.D.S.D. Dep. var	1.90	2.21	1.94	2.17
Log -likelihood	-108.28	-114.17	-107.53	-110.23
D -W stat	1.26	1.04	0.98	1.04

0.01***, 0.05**, 0.10*** at the level of significan**ce,** the above table shows the impact of energy on countries' economic growth. Coal has less impact on lower-income growth than other income groups of countries. Electricity is an essential variable for all four levels of income group showing a highly significant impact on the growth of countries. Gas is less critical for high-income level countries than other levels of income group, which shows high significance. Oil is equally crucial for all levels of income countries, and his signature is on the top level.

Conclusion

The paper identifies the relationship between energy consumption and economic development between 1991 toward 2021 by applying causality tests and the ordinary least square model. Oil Petroleum's mean of 12671045 and standard deviation 6675020 is highest compared to other energy source variables, which means it's a more critical and high volume of impacting the energy source of share. Energy source Gas on 2nd, Electricity on 3rd and Coal shares in energy generation on fourth place. Oil is getting more attraction and leading energy sources than other energy sources. The trend and stationary at level, 1st difference level; Coal is 3.6769 at the level and

first difference at -5.5701***; Electricity 0.6456 at the level and first difference at -4.0361***, Oil -1.6004 at the level and -4.2745*** first difference 1% on stationary found and Gas -1.8465 at the level and first level at -0.6348* showing 10% on stationery, so, data is the perfect stationary use for time series analysis. Johansen Co-integration test Residual variance used to measure the relationship in the short run/long run. Oil at 1130000000000, Electricity at 3933533, and Coal is at 977465 are equally significant for short-run/long run.
While Gas 1760000000 short run and 5090000000 for a long run, almost 1:3 ratio impacts economies, but as compared to oil is less impact source of energy on the economic growth of countries. Vector Error Correction Estimates of Coal, Electricity, Gas and Oil, which show the short-run and long-run behavior for the economy, energy behavior for countries growth; Co integrating Eq; Coal (-1) at 1.000000, Gas (-1) at 0.002136, Oil (-1) at 0.000393, electricity (-1) at -0.226915 showing the long-run behavior and d(coal(-1)), d(gas(-1)), d(oil(-1)), d(electricity(-1)) and d(coal(-2)), d(gas(-2)), d(oil(-2)), d(electricity(-2)) values are showing short-run energy impact on countries growth. The probability value used for estimation is less than any significance level; we accept it at that level, the value is above the significant level, and we can reject the hypothesis. Gas-high income at 0.0002; Gas-upper middle income at 0.0494; Gas-middle income at 0.0134; Gas-low middle income at 0.0303; Oil-high income at 0.0804; electricity-high income at 0.0004 and Electricity does not granger cause middle income at 0.0921; we can accept hypothesis because p-value under the significant level 1%, 5% and 10% and all others variable can reject; its p values are above the significant level. A unidirectional causality is found among energy consumptions to countries growth economies. The impact of energy sources used on the economic growth of countries. Oil and Electricity is the essential variable for all four levels of income group showing a highly significant impact on the growth of countries. Coal has less impact on lower-income and Gas is less important for high-income level countries than other levels of income group, which shows high significance. The above scenario shows energy consumption is the most important factor for economic progress. Consumption of energy enhances the production level in the economy, and when production increases, it generates employment opportunities in the country. Inversely, when a country faces an energy shortage that time manufacturing unit is badly affected, and production is reduced, the Industry stops working and does not meet orders. Investors do not invest in new projects. People go for unemployment and living standard dropdown. So governments need to avoid that situation and plan for energy, install new projects, direct investment national or foreign, and extend energy capacity. Here I mention some main problems that lead to energy shortage, and government policymakers try to overcome that issue and increase energy capacity in a short and long time.

Reasons

The main reason for the shortage of energy identified as under.

Shortage of Gas for the energy sector: Pakistan is producing largely energy through natural gas, but in winter, Pakistan face the problem of Gas shortfalls, so it also affects energy generation and big share cut off.

Electricity robbery and bills recoveries: Every year's energy losses through robbery are Rs.260 billion, which creates debt on govt. Theft in the energy sector discourages investors from investing in this sector. Pakistan lost 10 billion and 63 billion in the energy sector in 2008 and 2012, respectively.

Hydro energy generation reduction and cost effect: Hydro capacity of Pakistan is 6600 MW but not proper maintenances and renewable the system. Currently, generation is 3600 MW.

Transmission lines losses: Open energy networks and old transmission lines cause line losses. Pakistan every year bears losses of 18793000000 in 2020, according to the report of the World Bank.

Circular of Debt: Pakistan is facing problems of circular debt rapidly. In 2020-21 govt. clear all circular debt and timely increase energy production, but circular debts again create. The financial budget of 2020 and 15 mentions Rs.350 billion for subsidies, but actual subsidies are extended near about Rs.600 billion that condition go to more and more shortfalls of energy.

Important Recommendations

- Natural Gas resources provide for energy Production.
- Coal resource use for energy generation is cheaper compared to Oil sources.
- Alternative sources used for energy production like wind, solar, and bio- mass-generated energy are cheaper.
- Energy produces through Coal and hydro is cheaper rather than other sources.
- Monitoring body establishes for theft and line losses matters.
- Govt. must invest more in the energy sector and convince a foreign investor to invest in the energy sector.

- Improve bill recoveries, clear circular debt and up the cash flow in the energy sector. It leads to an increase in the generation of energy.

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