Measuring Coherence Between Electricity and Environmental Policies of Pakistan

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Abstract

Pakistan is one of the highly exposed countries to climate change. Energy sector being dependent on thermal resources is contributing largely to the environmental degradation. This requires integrating the environmental sustainability with the energy policy formulation. This paper discusses the interactions between electricity and environment related policies of Pakistan. The paper aims to find out synergies and conflicts by measuring coherence between electricity and environment policies. Analytical approach for policy analysis has been used which consisted of two steps. First step required to select the over-arching objectives of current policies on electricity and environment while the second step was to generate a screening matrix based on the policy interactions. Screening matrix has shown the coherence level between different objectives of power and environmental policies. The results indicated that electricity and environment policies in Pakistan are not complementing each other. Policy formulation requires detailed analysis to usher coherence among policies which will help in achieving the objectives of a sustainable electricity infrastructure in Pakistan.

Keywords: Electricity, Environment, Pakistan, Coherence, Policies

Introduction

There is an increasing demand by the policy makers all around the world to develop sustainable energy policies for developing countries to provide access of safe, affordable and modern electricity services which are essential to achieve Sustainable Development Goals defined by United Nations (Lu et al., 2015). The current status of electricity in many developing countries like Pakistan have raised concerns about the efficiency of various strategies and policies that intersect in power sector, questioning both their interaction with power policy and their effectiveness in addressing issues present in power sector of Pakistan. Policy coherence has become extremely important in many developed countries and there has been a need to develop coherent and consistent policies in developing countries like Pakistan to achieve sustainability in power sector because of the interconnections between power, environmental, social and economic sectors. Since, Pakistan is a developing country coherent power policy could help in achieving sustainable energy infrastructure in Pakistan which would result in economic boost, environmental protection and improved living conditions of people. Coherence can be defined as confirming that institutions and policies are not in conflict with each other and are moving in the same direction while complementing each other or at least having neutral effect on each other (Duraiappah & Bhardwaj, 2007) (please also see Box 1). Various studies have measured coherence between energy, environment and social policies across different countries (Fertel et al., 2013, Nilsson et al., 2012, Nilsson & Persson 2003, Kalaba, Quinn, & Dougill, 2013, Strambo, Nilsson, & Månsson, 2015) . But according to the best of our knowledge, no study on measuring coherence between power and other sectorial policies has been carried out in Pakistan.

Access of uninterrupted and clean electricity can help in solving many social, economic and environmental challenges in developing countries like Pakistan. In Pakistan around 51.9 million people doesn't have access to electricity and 56.56% of the total population doesn't have access to clean cooking technologies (WorldBank, 2018). Although progress has been made in this sector but still it is very low as compared to developed countries. This low access of electricity and clean cooking technologies results in low living standards and above all, this aid gender discrimination in under developed societies where

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Box 1: Factors important for coherence

Factors important for policy coherence

- Sectoral integration
- Communication between national and provincial governments
- Sectoral capacity building
- Integration of actors which implement the policies
- Interplay of management
- Policy learning among sectors

women and children collects firewood and other bio fuels to fulfill their energy needs and therefore, they are deprived of their basic human rights (González-Eguino, 2015; Pachauri & Rao, 2013). This use of firewood and biofuels has negative impacts on the environmental conditions as well because use of such sources results in emission of GHG gases which are considered as the main reason for climate change (Bélaïd & Youssef, 2017). It has been observed by United Nations Commission for Sustainable Development that lack of electricity not only hampers economic growth and development of a country but also results in environmental degradation (Acharya, 2018). Hence, it can be concluded that the access of clean and affordable energy is critical for reducing poverty, improving living standards, clean environment, economic development and overall wellbeing of society. Since, all these sectors are interconnected, the policies developed in these sectors must be coherent, synergic and should complement each other to avoid any obstruction and inconsistency. The aim of this study is to understand interactions between power and other sectorial policies like environmental, social and economic policies of Pakistan and to find any inconsistencies within these policies and strategies developed by the Government of Pakistan.

This study takes on an analytical approach for the analysis of national policies in energy, economic, environmental and social departments. Therefore, this study would be useful to develop coherent power policies and programs in Pakistan to provide clean, affordable and reliable power to 200 million people which would result in economic growth, environmental protection and upgradation of living standards of society.

Sustainability and Power sector development in Pakistan

One of the initial steps regarding the development of power sector in Pakistan was the creation of Water and Power Development Authority (WAPDA) in 1958. There was no private investment in the power sector of Pakistan until first power policy came in 1994 to attract private investment in Pakistan. This policy attracted more investment in thermal power generation than in hydropower. To overcome this problem, government announced a Hydro Power Policy in 1995 to boost the interest of private sector in hydro power generation. In 1998, another power policy was developed to attract private investment in indigenous coal and hydro based generation. Policy for Power Generation 2002 gave the responsibility of developing projects of 50 MW and above to the federal government and less than 50 MW projects to the provincial governments. First policy regarding energy conservation & efficiency was announced in 2005 to introduce a trend of energy conservation and efficiency in Pakistan. In 2006 alternative and renewable energy policy was also announced to increase the concentration of renewable energy in national grid. This policy was updated in 2011. In 2013, new power policy was developed which was aimed to resolve the main issues like demand supply gap in the power sector of Pakistan. Power generation policy was announced in 2015 to increase power supply at least cost (please also see (Table 1 Power Policies of Pakistan) shows the history and purposes of Pakistan's power related policies and Table 2 for power contracted under different policies) (GOP 2005a, 2011, 2012, 2005b, 2015b, 2013).

Being a developing country in the age of industrialization, Pakistan's energy demand is increasing rapidly (Shakeel, Takala & Shakeel, 2016). Pakistan's electricity consumption per capita has increased from 0.37 MWh in 2000 to 0.5 MWh in 2016 as shown in Figure 1 which resulted in an increase in CO2 emissions as shown in Figure 2. Despite increase in the electricity consumption per capita, approximately

51.9 million people are living without electricity because of low electrification rate in Pakistan as shown in Figure 3 (IEA, 2018, WorldBank, 2018).

According to NTDC (National Transmission and Despatch Company), electricity demand is increasing by about 5 to 6 percent annually that will reach to 32,000 MW by the end of 2020 (Malik et al., 2014). Due to increasing demand, there is a peak shortfall of around 3000 MW to 5000 MW in Pakistan (Aized et al., 2018). Main reasons of this shortfall are increased dependence on furnace oil, poor thermal efficiency, power theft, circular debt and high transmission & distribution losses.

Table 1: Overview of Power Policies' Objectives in Pakistan

Policy	Date	Objectives
National Power Policy	1994	This was the first power policy of Pakistan. It was intended to attract private investment. In this policy GOP decided to de-centralize WAPDA
Hydro Power Policy	1995	GOP announced this policy to attract private investment in the hydro sector of Pakistan
Policy for New Private Independent Power Projects	1998	This policy encouraged the private investors to invest in indigenous coal and hydro sector of Pakistan
Policy for Power Generation	2002	This policy made federal government responsible for power projects above 50 MW and provincial governments were made responsible for projects under 50 MW capacity
National Energy Conservation Policy	2005	This policy was aimed to increase efficiency in power generation and to develop a trend of energy conservation by introducing energy efficient appliances and to increase public awareness by running different campaigns.
Alternative and Renewable Energy Policy	2006	This policy aimed to increase the share of alternative and renewable energy sources in the energy mix of Pakistan.
Alternative and Renewable Energy Policy	2011	ARE policy 2011 which is basically an up-gradation of 2006 policy.
National Power Policy	2013	This policy aimed at ending the energy shortfall, reducing energy cost, reducing losses in transmission & distribution sector and increasing collection of bills till 2017.
Power Generation Policy	2015	This policy again focused on increasing generation at least cost.

Source: Various power policies of Pakistan

Table 2: Addition of installed capacity under different power policies

Project Category	Power Policy 1994	Power Policy 1995	Power Policy 1998	Power Policy 2002	Power Policy 2015
Thermal Projects Capacity	4340 MW	Not applicable	No Project Registered	3262 MW	13053 MW
Hydropower Projects Capacity	0	84 MW	No Project Registered	5373 MW	860 MW

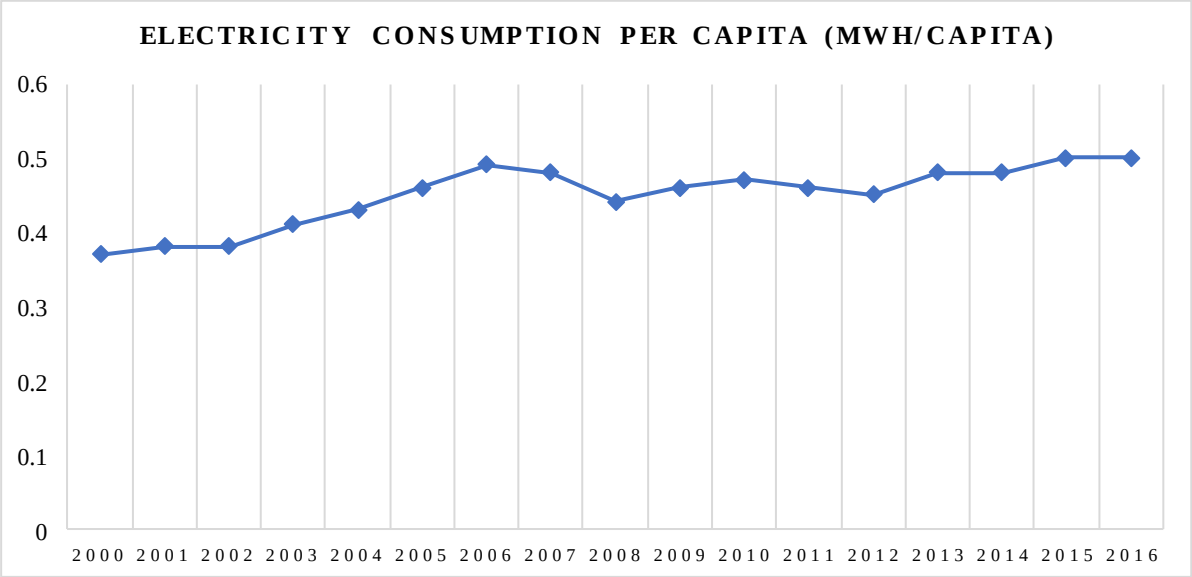
Source: Various power policies and NEPRA reports

In Pakistan, major share of electricity is produced from fossil fuels as shown in Figure 4 (Electricity production from renewable and non-renewable resources in Pakistan) which are resulting in an increase of CO_2 emissions in Pakistan as shown in Figure 2. One of the main reasons for favoring thermal

based electricity production and not taking environmental aspects into consideration was the absence of environment policy at the time of formulating first Power Policy in 1994.

According to vision 2025, Pakistan will be aiming to double its GDP growth and boost its industrial and transportation activities by the completion of CPEC. As a part of CPEC, Pakistan is also aiming to increase its electricity production up to 45,000 MW which has mostly been planned from the fossil fuels thus carrying potential of more harm to the environment Figure 5 (Electricity Projects Initiated under CPEC by Source) (CPEC, 2018).

Figure 1: Electricity consumption per capita (MWh/capita)



Energy has become a vital factor of economic growth in any country. Since economic development of a country is represented by its GDP growth Figure 6 (Relationship between GDP and electricity consumption) shows the interaction between percentage increase in electricity consumption and GDP growth of Pakistan. Between 2005 and 2011 when electricity shortage increased in Pakistan and its annual increase in electricity consumption was reduced, the GDP growth rate of Pakistan also decreased. Therefore, it implies that a correlation exists between energy and economic development.

Both renewable and nonrenewable energy consumption is linked with economic growth of a country. A study by (Shahbaz, Zeshan & Afza, 2012) concludes that cointegration exists between energy consumption from nonrenewable resources, energy consumption from renewable resources and economic growth. Increase in energy consumption either through renewable or nonrenewable sources would result in increased economic growth but it raises a concern of environmental degradation in case of nonrenewable resources (Rehman et al., 2019). A study by (Alam, Fatima & Butt, 2007) find out that if there is an economic growth of 1% then it will result in an increase of 0.84% of CO2 emissions whereas an increase of 1% in energy intensity and CO2 emissions will result in 0.3% and 1.2% increase in development respectively. An assessment by (Nasir & Rehman, 2011) reveals that a rise of 1% in GDP per capita would result in 7.20% increase in GHG emissions. But in some sectors like transport and residential increased energy consumption would not necessarily mean an increase in economic growth because the activities in both these sectors are considered as non-economic activities. Therefore, energy conservation & efficiency is highly recommended and promoted in these sectors (Rehman et al., 2019).

Figure 2: CO_2/population (t CO_2/capita)

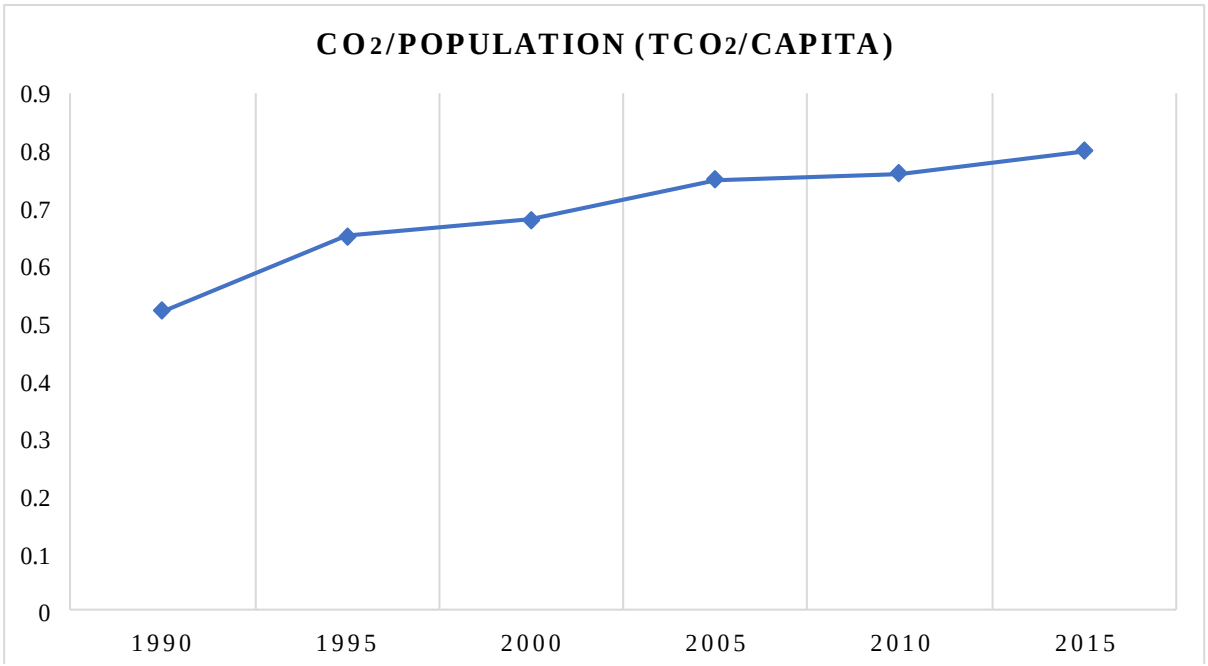


Figure 3: National electrification rate of Pakistan

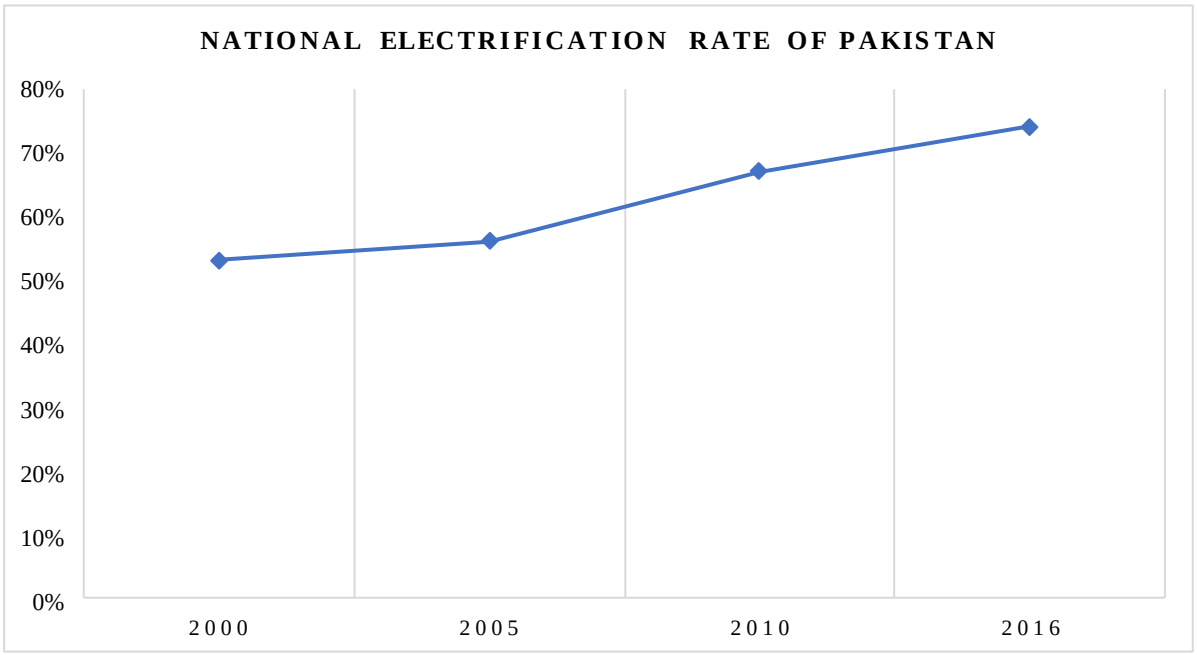


Figure 4: Electricity production from renewable and non-renewable resources in Pakistan

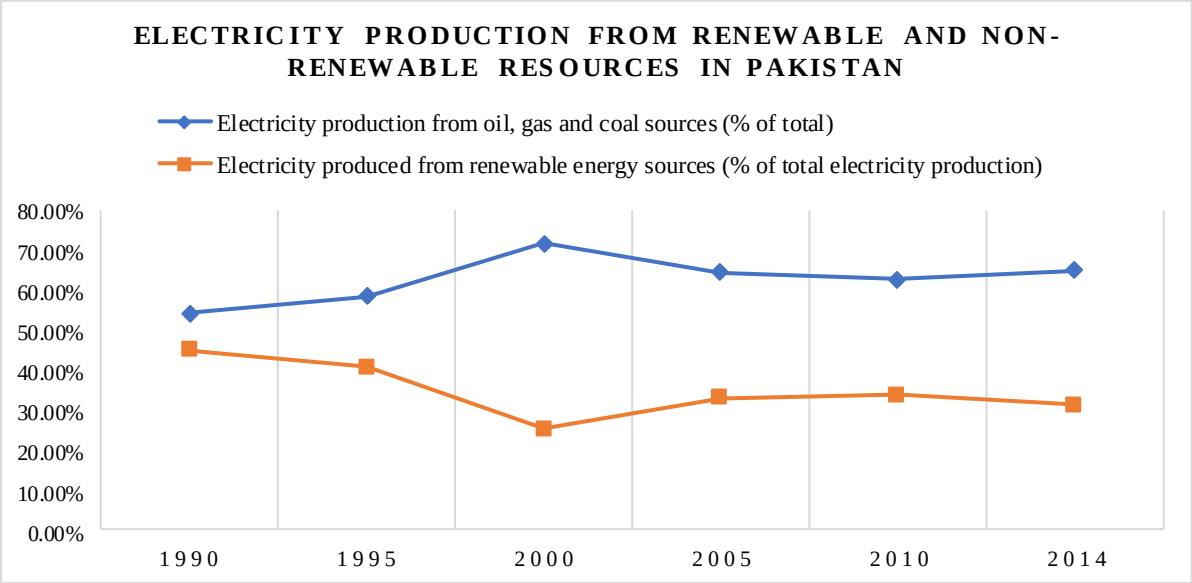


Figure 5: Electricity Projects Initiated under CPEC by Source (CPEC 2018)

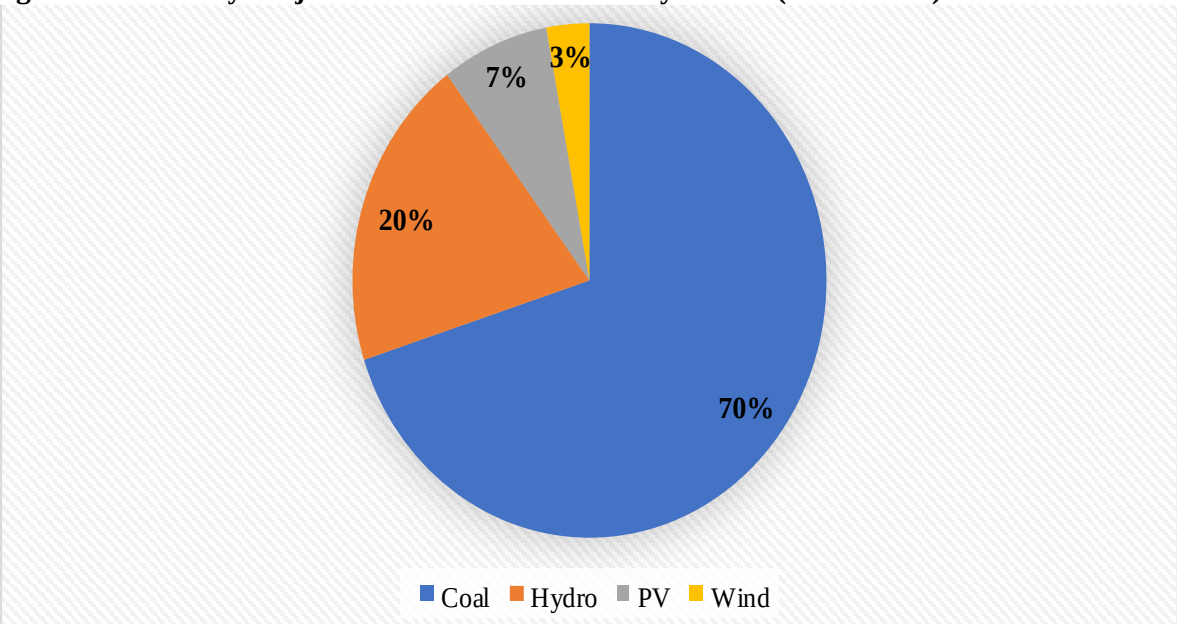
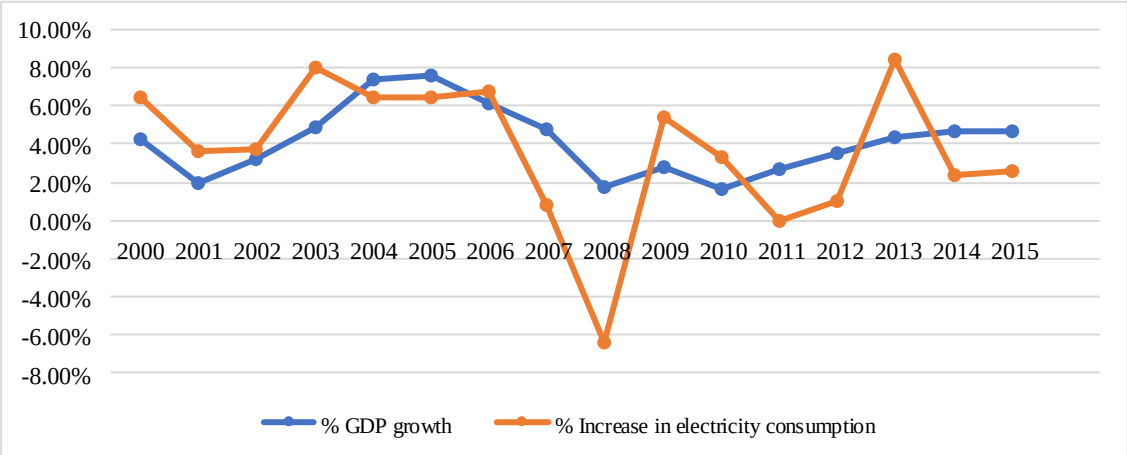


Figure 6: Relationship between GDP and electricity consumption



Pakistan is expected to have an energy growth of 8.8% in the future and will have a demand of 361 MTOE by 2030 (Khan et al., 2016). Consequently, Pakistan needs consistent addition of new power plants in the respective systems because increased energy poverty in Pakistan would result in decreased quality and efficiency of education, healthcare etc. whereas access of affordable electricity would result in increased opportunities and elimination of socio-economic deficit. For example, women and children who spend most of their time in the collection of firewood and other biofuels would be able to use that time for studying and will be protected from indoor pollution due to the emissions caused by burning of these resources (Acharya, 2018). Hence, Pakistan must increase its energy production to meet the economic growth rate and reduce energy poverty in the country.

Currently Pakistan is fulfilling most of its electricity needs from fossil fuels which are the biggest source of CO2 emission in the country (Nasir & Rehman, 2011, Mohiuddin, Asumadu-Sarkodie & Obaidullah, 2016). This is because the previous power policies of Pakistan have encouraged thermal power projects and pro-oil generation to reduce supply-demand gap (Qudrat-Ullah, 2015), without considering the environmentalists' concerns (Waleed, Akhtar & Pasha, 2018). Scientists from Inter-Governmental Panel on Climate Change (IPCC) have predicted a 2.5 to 10 degrees rise in global temperature in 100 years (Pachauri et al. 2014, GOP 2015a). In the last few decades, climate change accounted for more than 90% of all the reported natural disasters (IFRC 2003). For instance, damages caused by the 2010 floods in Pakistan were roughly around US$ 9.7 Billion (UNICEF 2011). Although GHG emissions of Pakistan are on a lower side but the location of Pakistan makes it vulnerable to the disastrous effects of climate change (GOP, 2016). Pakistan is said to be a victim of "climate injustice" (Aslam et al. 2011).

The severity of situation requires seriousness from the relevant stakeholders for devising cohesive policies concerning environment, economy, society and energy in the country.

Policy coherence

Policy coherence has gained momentum in recent years and it is now considered an important part of the policy making process. Policy makers are trying to make power, economic, social and environment policies more coherent by understanding how these policies interact with each other (Duraiappah & Bhardwaj, 2007, Forster & Stokke, 2013). Importance of coherence among policies has increased because the human activities in modern days have complicated the socio-technical systems of energy and environment. Coherence among a particular set of policies reduces conflicts by increasing synergies which ultimately increases sustainability of the target sector (Nilsson et al., 2012).

Conceptually, policy coherence seems a simple concept but its implementation and measurement involves a high level of difficulty since it is a relative term (May, Sapotichne & Workman, 2006). In many cases, incoherence is usually hidden at higher levels of a policy. Conflicts between policies can also occur

when office holders and officials interfere and distort formal policies in several ways that may result in outcomes not intended by the legislators.

Integration and coherence can be easily confused with each other because there is a lack of delineation between these two terms. Integration is mainly concerned with the policy inputs while coherence deals with results of the policies. The term "policy effectiveness" is also confused with policy coherence. A policy can be effective and incoherent at the same time (Nilsson et al., 2012).

Much work has been done globally to integrate environmental, economic and social policies with the national energy policies. During the World Summit for Sustainable Development, Intergovernmental Group of Ministers (IGM) was established under United Nations Environmental Program (UNEP) to overcome policy-oriented conflicts between different sectors and to take initiatives for increasing synergies and positive interactions between those. One of the objectives was to integrate environmental conventions with other institutions so that coherence can be achieved between them (Tarasofsky, 2002). There are 13 Multilateral Environmental Agreements (MEAs) (Pisupati and UNEP, 2016) and more than 500 international agreements related to environment. Due to the conflicts between different institutions, these agreements and treaties have become inefficient. Therefore, the policy coherence has become one of most important challenges for the Inter-Governmental Organizations (IGOs) (Pisupati and UNEP, 2016).

The Global Environmental Facility (GEF) also put emphasis on policy coherence by supporting interactions between climate change, international waters, ozone, land degradation, biodiversity and persistent organic pollutants as all of these sectors are closely linked and effect each other (GEF 2016). Organizations like OECD (OECD, 2016), EU (Carbone & Keijzer, 2016) and UN (UN, 2018) have emphasized the policy coherence in different fields and provided detailed studies on policy coherence to achieve Sustainable Development Goals. United Nations Organization on Food and Agriculture (FAO, 2005) has emphasized on policy coherence to ensure food security (Pingali, Stamoulis, & Stringer, 2006; Robertson, 2014). IISD (International Institute for Sustainable Development) (Duraiappah & Bhardwaj, 2007) has also done detailed work on policy coherence. In short, policy coherence among different sectors has been recognized as an important component of policy making processes among developed countries and the global organizations to ensure sustainability of the socio-technical systems.

Types of policy coherence

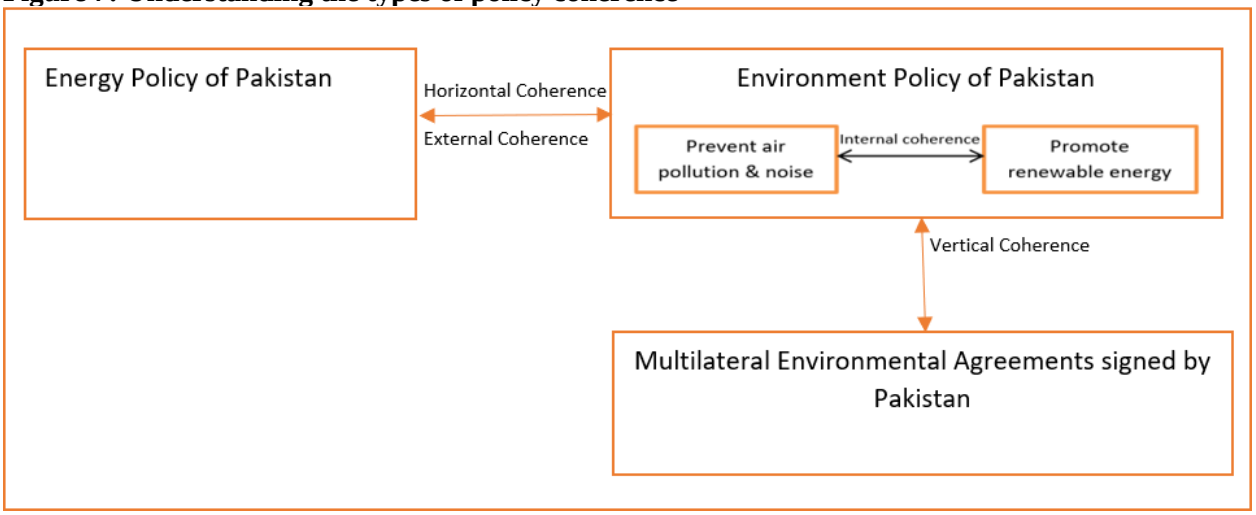
Coherence can be categorized in four types namely vertical, horizontal, internal and external (Carbone, 2008) (please also see Table 3 Types of policy coherence). Policy coherence can be studied within an individual policy domain (internal coherence) and also between different policy domains (external coherence) (Forster & Stokke, 2013). For instance, coherence can be measured between objectives of energy policy as well as between energy and economic policies. Policy coherence can also be measured vertically; it is basically measuring coherence between different levels of governance such as interactions between the international environmental protocols signed by Pakistan and environmental policy of Pakistan. Figure 7 (Understanding the types of policy coherence) explains different types of policy coherence with brief examples.

Table 3: Types of policy coherence

	Horizontal	Vertical
Internal	Coherence between different objectives of same level policies i.e. coherence between renewable energy policy and power policy.	Coherence between objectives of policies at different level i.e. coherence between Multilateral Environmental Agreements and Pakistan's climate change policy.
External	Coherence between the objectives of different policies present at the same level i.e. coherence between energy security policy and poverty reduction policy.	Coherence between different policies present at different levels i.e. coherence between National Energy Policy of Pakistan and Environmental Policy of Punjab.

Source: (May, Sapotichne & Workman, 2006)

Figure 7: Understanding the types of policy coherence



Policy coherence around the world

Various scholars have also studied coherence among a range of organizations and policies in developed countries to achieve long term development goals. Table 4 (Policy coherence around the world) shows the research studies carried out in different countries around the world.

Energy and environment policy coherence in developing countries

Currently, policy coherence is worked upon in many countries especially in the European Union (Carbone, 2013, Nilsson et al., 2012, Fertel et al., 2013), however developing countries have a little or no emphasis in this field. A few studies regarding policy coherence are carried out in developing countries around Africa and Asia but to the best of our knowledge, no study has been conducted on the measurement of coherence between policies of Pakistan. This paper investigates the coherence between important sectors in Pakistan.

Methodology

Coherence can be measured by using SWOT analysis (Fertel et al., 2013), analytical approach (Nilsson et al., 2012) as well as the quantitative and qualitative analysis (Brooks, 2014). In this paper, analytical approach is used as it gives a clear picture of the inconsistencies present in policies. The analytical approach is used in two steps.

First step of analytical method includes the selection of policies required to be studied. Table 6 (Selected power, environment, economy and social policies of Pakistan) shows power, economic, social and environmental policies selected to measure coherence. Then, objectives and goals of policies are identified. In our case, power and environment related policies of Pakistan are selected.

Table 4: Policy coherence around the world

Title	Year	Theme	Reference
Canadian energy and climate policies: A SWOT analysis in search of federal/provincial coherence	2013	Federal and provincial policy coherence	(Fertel et al. 2013)
Understanding Policy Coherence: Analytical Framework and Examples of Sector–Environment Policy Interactions in the EU	2012	Environmental policy interactions with other sectors in EU	(Nilsson et al. 2012)
The Evaluation of Policy Coherence for Development	2005	Improving consistency between the global poverty reduction policies of rich countries	(Picciotto 2005)
Measuring Policy Coherence among the MEAs and MDGs	2007	Policy coherence between MEAs and MDGs of UN	(Duraiappah and Bhardwaj 2007)
A qualitative look at the coherence between EU energy security and climate change policies	2014	Measuring coherence between energy security and climate change policy of EU	(Nilsson, Strambo, and Månsson 2014)
Coherent or inconsistent? Assessing energy security and climate policy interaction within the European Union	2015	Measuring coherence between energy security and climate change policy of EU	(Strambo, Nilsson, and Månsson 2015)
The European Union and policy coherence for development: Reforms, results, resistance	2016	Policy coherence for development in EU	(Carbone and Keijzer 2016)
Mission Impossible: the European Union and Policy Coherence for Development	2008	Interplay between policy coherence for development and EU policies, interests and EU's institutional framework	(Carbone 2008)
Environmental policy integration in practice: Shaping institutions for learning	2009	Detailed review of environmental policy integration at national level with focus on energy and agricultural sector of Sweden	(Eckerberg 2009)

Table 5: Studies regarding policy coherence in developing countries

Title	Year	Theme	Reference
Policy coherence and interplay between Zambia's forest, energy, agricultural and climate change policies and multilateral environmental agreements	2013	Measuring policy coherence between Zambia forestation policy and energy, agriculture, climate change policies	(Kalaba, Quinn & Dougill, 2013)
Policy coherence for sustainable development in Sub-Saharan Africa	2018	Policy coherence in energy, food and water to achieve the goals of Paris Agreement on climate change	(Curran et al., 2018)

Second step includes building of a screening matrix showing the interactions between the two sectoral policies. Objectives of power related policies of Pakistan are on vertical axis and objectives of environment related policies of Pakistan are on the horizontal axis. The interactions can vary between strong (2) and neutral (0). Conflicts are indicated by (-) and synergy is represented by (+). So, +2 will mean

strong synergy between objectives, -2 will mean strong conflict between objectives and +/- 0 will mean the objectives don't affect each other.

The results are based on analytical study of policies and are based on predictions, arguments and indications of the policy outcomes. The inventory of the power, social, economic and environment policy objectives is given in Table 7 (overreaching objectives of sectorial policies of Pakistan).

Table 6: Selected power, environment, economy and social policies of Pakistan

Document	Ministry/Department
National Power Policy 2013	Ministry of Water and Power
National Power Generation Policy 2015	Ministry of Water and Power
National Energy Conservation & Efficiency Policy 2005	National Energy Efficiency & Conservation Authority
Alternative and Renewable Energy Policy 2011	Alternative Energy Development Board
National Environment policy of Pakistan 2006	Ministry of Climate Change
National Climate change policy 2012	Ministry of Climate Change
National Forest policy 2015	Ministry of Climate Change
Strategic Trade Policy Framework 2015-18	Ministry of Commerce
Fiscal Policy statement 2017-18	Ministry of Finance
Monetary Policy Statement 2018	State Bank of Pakistan
Custom Act 1969 2017	Federal Bureau of Revenue
Export Policy order 2015-18	Ministry of Commerce
Import Policy order 2015-18	Ministry of Commerce
Poverty reduction strategy paper – II	Ministry of Finance
Vision 2025	Ministry of Planning, Development and Reform
Poverty reduction strategy paper report 2011-12	Ministry of Finance

Results and Discussion

Power and environment

Table 8 (Screening matrix for power and environment policies of Pakistan) shows the interactions between power and environment related policies of Pakistan. Objectives like production of electricity from imported and indigenous coal resources are in direct conflict with environmental policies because of large amount of GHG emissions associated with them. In contrast, power policy measures like promotion of energy conservation & efficiency and power infrastructure improvement by nature have high synergistic relationship with environmental policies. In short term there isn't much relationship between electricity infrastructure and environmental goals. But in long term it can have positive effect in reducing the GHG emissions and protecting environment against air pollution, ozone depletion, conservation of natural resources etc. It also has a positive synergy with energy security of Pakistan. In a monitoring report published in 2017 by Energy Sector Reforms Program, it was stated that GOP (Government of Pakistan) is trying to reduce distribution losses from 23%-25% to 16% (GOP, 2017) to reduce demand and supply gap. With such high distribution losses, a lot of power is wasted and thus further increases the supply demand gap. Therefore, with improved electricity infrastructure both power and environment policies can become more sustainable. Promotion of indigenous hydro and bio fuels have interesting relationship with the environment as they have both positive and negative relationship with environment. Since, in short term bio gas can help in reducing GHG emissions but in long term it can be harmful for conservation of natural resources like biodiversity and land use. So, there aren't any direct effects of bio gas on environment but indirect effects like the ones mentioned above. Table 8 (Screening matrix for power and environment policies of Pakistan) shows the interactions between power and environment related policies of Pakistan. (Nilsson et al., 2012) has also employed this approach to measure inconsistencies in EU energy and environment policies and has found out that the presence of policy objectives related to fossil fuels provides conflict with the environment policies present in EU.

Table 7: Overreaching objectives of sectorial policies of Pakistan

Power Sector							
Power Policy							
P1 Promote energy conservation & efficiency	P2 Generation of affordable electricity	P3 Upgradation of transmission & distribution system	P4 Improve technology standards	P5 Minimize financial losses	P6 Promote production from indigenous coal resources	P7 Promotion of electricity production from imported coal	P8 Promotion of indigenous RE resources i.e. hydro, wind, solar and biofuels
Energy Conservation & efficiency policy							
E1 Energy conservation & efficiency codes	E2 Reducing energy intensity	E3 Introduction of energy labels & MEPS	E4 Energy audits in industry	E5 Cost-effective energy efficiency	E6 Reduce CO2 emissions	E7 Promote efficiency in transport sector	
Alternate and renewable energy policy							
R1 Achieve 5% of total commercial supply by RE	R2 Energy to produce from alternative fuels & renewable resources	R3 Promote private sector investment in ARE projects	R4 Tackle poverty by ARE projects in under developed areas	R5 Mandatory purchase of power from ARE projects	R6 Incentives for ARE projects from GOP	R7 Net-Metering allowed for up to 1MW projects	
Power generation policy							
G1 Promotion of public private partnership	G2 Incentives to new IPPs & PPPs						
Sectoral Policies							
Economic Policy							
M1 Improve bill collection	M2 Promotion of freight trains	M3 Energy produced from shredded tyres	M4 Euro-II standard for vehicle import	M5 Ozone depleting products import banned	M6 High custom duty on vehicles irrespective of their efficiency	M7 0% import duty on solar energy products	M8 CNG cylinder & conversion kits banned	M9 Rationalization of subsidies
Environment policy							
C1 Conservation of natural resources i.e. agricultural lands, forests etc.	C2 Enforce land and air quality standards	C3 Reduction of harmful emissions from all sectors	C4 Standards for vehicle manufacturing & fuels used in them	C5 Cost-effective public transport & promotion of cycling & walking	C6 Stand-alone RE systems for rural electrification	C7 Incentives for use of efficient products	C8 Expansion of nuclear energy & use of clean coal technologies	C9 Carbon taxing & storage
Social policy							
S1 Energy supply to industry for jobs creation	S2 Electrification	S3 Increase coal base electricity production	S4 Special incentives for consumers below poverty line	S5 Subsidy on efficient water & energy technologies	S6 Increasing electricity consumption per capita	S7 Exploration & Development program for crude oil		

Table 8: Screening matrix for power and environment policies of Pakistan

	C1	C2	C3	C4	C5	C6	C7	C8	C9
P1	0/+1	0	0	+1	+2	0	+2	0	0
P2	0	0	0	0	0	+1	+1	+1	0
P3	0	0	+1	0	0	0	0	+1	0
P4	0	0	0	+1	0	0	+1	0	0
P5	0	0	0	0	+1	+1	+1	0	+1
P6	-1	-1	-1	0	0	-1	0	+1	0
P7	0	-1	-1	0	0	-1	0	+1	0
P8	+2/-2	+2	+2/-1	0	0	+2	0	-1	0
E1	0	0	0	+2	+1	0	+2	0	0
E2	+1	0	0	+1	+1	0	+1	0	0
E3	0	0	0	+2	0	0	+1	0	0
E4	0	0	0	0	0	0	+1	0	0
E5	0	0	0	+2	+2	0	+2	0	0
E6	0	+1	+2	+1	+1	+1	+1	+1	+2
E7	0	0	+1	+2	+2	0	+1	0	0
R1	+1	+1	+2	0	0	+2	0	-1	+1
R2	+1	+1	+2	0	0	+1	0	-1	+1
R3	+1	+1	+1	0	0	+1	0	-1	+1
R4	+1	+1	+1	0	0	+2	0	-1	+1
R5	+1	+1	+1	0	0	0	0	-1	+1
R6	+1	+1	+2	0	0	+2	0	-1	+1
R7	+1	+1	+1	0	0	0	0	-1	+1
G1	0	0	0	0	0	+1	0	0	0
G2	0	0	0	0	0	+1	0	+1	0

Power and economy

Since, energy and economy go side by side for the development of the living conditions of people, the interaction between policies of both sectors needs to be coherent and synergistic. Objectives of economic policy like euro II standards for import and no subsidy for hybrid vehicles have direct conflicts with many objectives of power policy e.g. energy conservation & efficiency, reduction of CO_2 emissions, improved standards etc. Pakistan can save almost US $4 Billion annually by energy conservation in agriculture, industry, transport and energy efficient buildings (Aslam et al., 2011). Therefore, GOP must incentivize energy conservation & efficiency by introduction of tax incentives for import and use of efficient products. Whereas, objectives like zero import duty on solar panels, promotion of freight trains and improving bill collection have positive impacts on the power sector of Pakistan. Table 9 (Screening matrix for power and economic policies) shows the complete interactions between economic and power policies of Pakistan.

Power and society

Energy has become an essential element for the development of society. Power policies of any country must be directed in a way to improve the living conditions of people. In Pakistan no framework exists for the electrification of un-electrified rural areas (SEforAll, 2018). Interactions between the power policies of Pakistan and social objectives are given in Table 10 (Screening matrix for power and social policies). Objective like P6 and P7 which are related with increasing electricity production have strong synergy with social policies as these objectives will help in removing energy poverty and provide more energy security.

Objectives related to renewable energy have conflicts with objective S3 which states that more electricity should be produced using indigenous coal which is a cheap source of electricity. Such inconsistencies should not be present at national level because it creates confusion and results into ineffectiveness of respective departments.

Table 9: Screening matrix for power and economic policies

	M1	M2	M3	M4	M5	M6	M7	M8	M9
P1	0	+1	0	-1	0	-2	0	-1	0
P2	0	0	+1	0	0	0	+1	0	+1
P3	0	0	0	0	0	0	0	0	0
P4	+1	0	0	-1	0	-1	0	-1	0
P5	+2	+1	+1	0	0	0	0	0	+2
P6	0	0	0	0	0	0	0	0	0
P7	0	0	0	0	0	0	0	0	0
P8	0	0	0	0	0	0	+2	0	0
E1	0	0	0	-1	0	-2	0	0	0
E2	0	+1	0	0	0	-1	0	0	0
E3	0	0	0	+1	0	0	0	0	0
E4	0	0	0	0	0	0	0	0	0
E5	0	+1	0	-1	0	-2	0	-1	+1
E6	0	+1	0	-1	+1	-1	+1	-1	0
E7	0	+2	0	-1	0	-2	0	-1	0
R1	0	0	0	0	+1	0	0	0	0
R2	0	0	+2	0	0	-1	+2	-1	0
R3	+1	0	+1	0	0	0	+1	0	+1
R4	0	0	+1	0	0	0	+1	0	0
R5	0	0	0	0	0	0	0	0	0
R6	0	0	0	0	+1	0	+2	0	0
R7	0	0	0	0	0	0	+1	0	0
G1	+1	0	0	0	0	0	0	0	0
G2	0	0	0	0	0	0	+1	0	0

Power, Economy, Environment and Society

Table 11 (Screening matrix for power, economy, environment and social policies) represents the accumulative results of policy interactions between power and sectorial policies, economy, environment and social. Objectives related energy conservation & efficiency have synergy with environmental policy objectives whereas it has conflict with many economic policy objectives and one social policy objective. This is because increased power use represents increased economic activity and plays a key role in GDP growth rate of a country. In Pakistan it was found that different power policies have varying impacts on the economy of Pakistan. Policies like price increase could really hamper the economy but the policies like introduction of energy efficient equipment and techniques in industrial and domestic sector could have a positive impact. For example, if energy conservation is achieved by direct curtailment policies it can really hurt Pakistan's trade. Because a sudden change in energy consumption could affect the production and transport ability of a country which in return will cause the export to fall down. Policy makers should keep in mind all these factors before making any energy policy(Raza, Shahbaz & Nguyen, 2015). So we can say that instead of using price and other direct curtailment policies government should focus on the policies improving energy efficiency(Mirza, Bergland & Afzal, 2014).

Table 10: Screening matrix for power and social policies

	S1	S2	S3	S4	S5	S6	S7
P1	0	0	0	0	+1	-1	0
P2	0	0	+1	0	+1	0	0
P3	+1	+2	+1	0	0	+1	0
P4	0	+1	-1	0	0	0	+1
P5	+1	0	+1	-1	+1	0	0
P6	+1	+1	+2	0	0	+1	+1
P7	+1	+1	+2	0	0	+1	0
P8	+1	+1	-2	0	+1	+1	0
E1	0	0	0	0	+1	-1	0
E2	0	0	0	0	+1	-1	0
E3	0	0	0	0	+1	0	0
E4	0	0	0	0	+1	0	0
E5	0	0	0	0	+1	0	0
E6	0	0	-2	0	+1	0	0
E7	0	0	0	0	0	0	0
R1	0	0	-1	0	0	0	0
R2	0	0	-1	0	0	0	0
R3	+1	+1	-1	0	+1	+1	0
R4	+1	+2	-1	+1	0	+1	0
R5	0	+1	-1	0	0	+1	0
R6	0	+1	-1	0	0	+1	0
R7	+1	0	0	0	+1	0	0
G1	+1	+1	+1	0	0	+1	0
G2	+1	+1	+1	0	0	+1	0

Table 11: Screening matrix for power, economy, environment and social policies

	M1	M2	M3	M4	M5	M6	M7	M8	M9	C1	C2	C3	C4	C5	C6	C7	C8	C9	S1	S2	S3	S4	S5	S6	S7
P1	**0**	**+1**	**0**	**-1**	**0**	**-2**	**0**	**-1**	**0**	**0/+1**	**0**	**0**	**+1**	**+2**	**0**	**+2**	**0**	**0**	**0**	**0**	**0**	**0**	**+1**	**-1**	**0**
P2	**0**	**0**	**+1**	**0**	**0**	**0**	**+1**	**0**	**+1**	**0**	**0**	**0**	**0**	**0**	**+1**	**+1**	**+1**	**0**	**0**	**0**	**+1**	**0**	**+1**	**0**	**0**
P3	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**+1**	**0**	**0**	**0**	**0**	**+1**	**0**	**+1**	**+2**	**+1**	**0**	**0**	**+1**	**0**
P4	**+1**	**0**	**0**	**-1**	**0**	**-1**	**0**	**-1**	**0**	**0**	**0**	**0**	**+1**	**0**	**0**	**+1**	**0**	**0**	**0**	**+1**	**-1**	**0**	**0**	**0**	**+1**
P5	**+2**	**+1**	**+1**	**0**	**0**	**0**	**0**	**0**	**+2**	**0**	**0**	**0**	**0**	**+1**	**+1**	**+1**	**0**	**+1**	**+1**	**0**	**+1**	**-1**	**+1**	**0**	**0**
P6	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**-1**	**-1**	**-1**	**0**	**0**	**-1**	**0**	**+1**	**0**	**+1**	**+1**	**+2**	**0**	**0**	**+1**	**+1**
P7	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**-1**	**-1**	**0**	**0**	**-1**	**0**	**+1**	**0**	**+1**	**+1**	**+2**	**0**	**0**	**+1**	**0**
P8	**0**	**0**	**0**	**0**	**0**	**0**	**+2**	**0**	**0**	**+2/-2**	**+2/-1**	**+2**	**0**	**0**	**+2**	**0**	**-1**	**0**	**+1**	**+1**	**-2**	**0**	**+1**	**+1**	**0**
E1	**0**	**0**	**0**	**-1**	**0**	**-2**	**0**	**0**	**0**	**0**	**0**	**0**	**+2**	**+1**	**0**	**+2**	**0**	**0**	**0**	**0**	**0**	**0**	**+1**	**-1**	**0**
E2	**0**	**+1**	**0**	**0**	**0**	**-1**	**0**	**0**	**0**	**+1**	**0**	**0**	**+1**	**+1**	**0**	**+1**	**0**	**0**	**0**	**0**	**0**	**0**	**+!**	**-1**	**0**
E3	**0**	**0**	**0**	**+1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**+2**	**0**	**0**	**+1**	**0**	**0**	**0**	**0**	**0**	**0**	**+1**	**0**	**0**
E4	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**+1**	**0**	**0**	**0**	**0**	**0**	**0**	**+1**	**0**	**0**
E5	**0**	**+1**	**0**	**-1**	**0**	**-2**	**0**	**-1**	**+1**	**0**	**0**	**0**	**+2**	**+2**	**0**	**+2**	**0**	**0**	**0**	**0**	**0**	**0**	**+1**	**0**	**0**
E6	**0**	**+1**	**0**	**-1**	**+1**	**-1**	**+1**	**-1**	**0**	**0**	**+1**	**+2**	**+1**	**+1**	**+1**	**+1**	**+1**	**+2**	**0**	**0**	**-2**	**0**	**+1**	**0**	**0**
E7	**0**	**+2**	**0**	**-1**	**0**	**-2**	**0**	**-1**	**0**	**0**	**0**	**+1**	**+2**	**+2**	**0**	**+1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
R1	**0**	**0**	**0**	**0**	**+1**	**0**	**0**	**0**	**0**	**+1**	**+1**	**+2**	**0**	**0**	**+2**	**0**	**-1**	**+1**	**0**	**0**	**-1**	**0**	**0**	**0**	**0**
R2	**0**	**0**	**+2**	**0**	**0**	**-1**	**+2**	**-1**	**0**	**+1**	**+1**	**+2**	**0**	**0**	**+1**	**0**	**-1**	**+1**	**0**	**0**	**-1**	**0**	**0**	**0**	**0**
R3	**+1**	**0**	**+1**	**0**	**0**	**0**	**+1**	**0**	**+1**	**+1**	**+1**	**+1**	**0**	**0**	**+1**	**0**	**-1**	**+1**	**+1**	**+1**	**-1**	**0**	**+1**	**+1**	**0**
R4	**0**	**0**	**+1**	**0**	**0**	**0**	**+1**	**0**	**0**	**+1**	**+1**	**+1**	**0**	**0**	**+2**	**0**	**-1**	**+1**	**+1**	**+2**	**-1**	**+1**	**0**	**+1**	**0**
R5	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**+1**	**+1**	**+1**	**0**	**0**	**0**	**0**	**-1**	**+1**	**0**	**+1**	**-1**	**0**	**0**	**+1**	**0**
R6	**0**	**0**	**0**	**0**	**+1**	**0**	**+2**	**0**	**0**	**+1**	**+1**	**+2**	**0**	**0**	**+2**	**0**	**-1**	**+1**	**0**	**+1**	**-1**	**0**	**0**	**+1**	**0**
R7	**0**	**0**	**0**	**0**	**0**	**0**	**+1**	**0**	**0**	**+1**	**+1**	**+1**	**0**	**0**	**0**	**0**	**-1**	**+1**	**+1**	**0**	**0**	**0**	**+1**	**0**	**0**
G1	**+1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**+1**	**0**	**0**	**0**	**+1**	**+1**	**+1**	**0**	**0**	**+1**	**0**
G2	**0**	**0**	**0**	**0**	**0**	**0**	**+1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**+1**	**0**	**+1**	**0**	**+1**	**+1**	**+1**	**0**	**0**	**+1**	**0**

Conclusion

Pakistan being a developing country is facing an increasing electricity demand. Access to clean and reliable energy would help in the economic growth of country. To meet the energy needs many power projects have been initiated under CPEC. Most of these projects are coal based and may not be sustainable as they will have drastic impacts on the environment. This paper has used analytical approach to show the interactions between the objectives of power, economic, social and environment related policies of Pakistan. Overall, results advocates that some coherence is present in the discussed policies, but further work is required to make them more coherent and consistent. These findings will help in making more efficient and coherent policies to resolve the issues like energy crisis, energy poverty, gender discrimination, economic growth, environmental protection etc. Incoherent objectives of the policies are highlighted. Paper suggest following policy recommendations.

- The production of electricity using indigenous and imported coal resources should be reduced in favor of indigenous renewable energy resources.
- Development of cogeneration plants should be prioritized for electricity generation in Pakistan
- Objectives like electricity production from waste resources must be included in both electricity and environment policies
- Introduction of a framework for the electrification of unelectrified rural areas
- Electricity crisis is deterring economic growth of Pakistan and it must be overcome quickly
- MEPS and energy labelling must be made compulsory
- Incentives should be available to use efficient and environment friendly products
- Net metering should be promoted in residential sector which will in turn promote renewable energy production at household level.

Policy makers in Pakistan need to foster coherence between power, economic, social and environment sectors so that a more sustainable electricity infrastructure might be envisioned.

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