# ALTERNATIVE AND RENEWABLE ENERGY POLICY 2019
# AN OVERVIEW


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I hereby declare that the thesis submitted by me titled **Alternative and Renewable Energy Policy 2019: An Overview** is based on my own research work and has not been submitted to any other institution for any other degree.

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# Abstract

It is evident that Pakistan has an energy dearth status which has adverse effects on economic growth. Pakistan's energy mix shows that the country has heavy dependence on imported fossil fuels and the national share of renewable energy resources up to 2.4% which is very negligible. Pakistan has formulated a number of policies for power and renewable energy, mainly addressing the power crisis of country. The emerging global trend towards renewables and the prevailing slowdown of economic activity demanded new policy based on emerging international standards and obligations. To effectively cover the energy, economy and environmental challenges the Government of Pakistan formulated the '*Alternative and Renewable Energy Policy 2019*' to enhance the renewable deployment, promising to ensure affordable and clean energy across all regions of Pakistan. The policy has recently passed from Council of Common Interest (CCI) and its operation and implementation phase invites analysis and evaluations to spot untapped areas and assess unidentified measures with more rationality. This study offers an overview of the policy based on the discourse analysis. The research methodology of our study is based on Hajer (2006) framework analysis and text mining of renewable energy policies of South Asian countries. In our study, we focused on three main pillars of public policy while exploring the policy discourse. These core areas are policy framework, institutional framework and implementation framework. After conducting in-depth interviews with the experts of renewable energy sector, this study identifies that there still exists certain loopholes, shortcomings and implementation hurdles in the policy. The infrastructural and technological barriers along with absence of reliable renewable resource data and unskilled workforce are major impediments as per findings of this study. By the use of text mining tools lexical dispersion and word cloud in this study, we compare the renewable energy policies of SAARC region. Every policy has some bright and some grey areas which is discussed in the analysis chapter of this study. The study recommends that there is need of time to exchange the new renewable technologies based on innovative experience, designing of mechanism to enhance the local entrepreneurships among SAARC countries.

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# CHAPTER 1 INTRODUCTION

## 1. Introduction

At the dawn of new millennium, global perspective of developed and developing nations has transformed mainly due to the experience of climate change and shifting energy prints. The new economic societies of modern world have mainly depended on assurance of ample energy supply. An established global consensus has marked that the consequent use of energy by liberty and autonomy is an elucidation to achieve and uphold the supreme affluence in a struggle of global challenges. The entire energy system endures a complete shift from non-renewables to resourceful renewables energy and this shift is linked with scientific advancement sited to keep climate change as fossil fuels.

The conventional sources of energy are responsible for depletion along with deplorably the environmental impacts, has created a momentous risk to global prospect safety, health quality and, social welfare. Non-renewable energy resources are being considered as a big source of carbon emission while the utilization of renewable energy is supportive in emission decline and induces efficient energy use. The practice of renewable energy sources has rapidly felt in the development of world during the last era. It accounted for approximately 20% of global energy use which is half of all new power generation. More than 150 countries have national targets for renewable energy in power and Denmark is the unique country in world which has target of 100% energy from renewable sources (REN21, 2018).

Around the world, there is an ever grown energy demand for secure future investments. Since the last decade, renewables have seen an incredible evolution as well as the worldwide trend for investment in renewable energy projects has noticeably increased i.e. from110 billion dollars to 300 billion dollars for last year's according to report of REN21, 2018. This gigantic swing towards renewables has also intensified the installation capacity of power generation which has doubled from 1100GW to 2200GW since 2010 (Kamran, Fazal, & Mudassar, 2020). With the mature renewable technologies and sharp cost reductions, the nations are adopting new renewable energy targets to attain secure, sustainable, cost effective and eco-friendly energy. Zeb (2014) explained the results of his studies that a casual relation shows the renewable development has effective environmental impacts with the decrease in carbon emission as positive impact in SAARC region by the use of renewable resources in energy production (Zeb, Salar, Awan, Zaman, & Shahbaz, 2014) The huge demand-supply gap in the power sector, the escalating cost of imported fuels and

terrible atmospheric pollution, all have urged the international community to create and accelerate an imperative hunt for an alternative, consistent, commercial and environment-friendly renewable energy resources to strengthen socio-economic development while combating climate challenges and air smog. Renewables may improve the resilience of energy system against the climate and natural disasters.

Energy is being considered as a public good as it greatly affects people's life and upholds one's living standards. Renewables have capacity to increase energy security[1] and decrease reliance on energy imports. Pakistan has 168GW potentials of renewable energy (Rafique & Rehman, 2017). Pakistan has remarkable potential to attach its home-grown renewables and energy-mix allocations to amplify and affirm energy security. Pakistan's geo-tropical location provides nonstop supply of solar energy throughout the year. Similarly, Pakistan has 1100 km coastal length with a high wind energy potential in the Sindh and Baluchistan. It is evident from available scientific literature on renewable integrated system that Pakistan has much more potential of wind power generation and concentrated solar power as compared to the solar PV. By the use of renewables, having diverse compensations like active converging effects and impacts on different stratum of economy as well as on the masses, is pivotal in provision of sustainable, economic and social equity. Solangi (2020) in his study using SWOT and Fuzzy Analytical Hierarchy Process identified a multi perspective approach of economic, environmental and technical factors that affect socio-political perspectives of renewable energy technologies in Pakistan (Wang, Xu, & Solangi, 2020). Energy demand is correlated with economic growth as it depends upon the factors like technological accessibility, life quality, real income and economic structure. Aziz (2019) using PAK-TIMES model explained the energy, economy and environment nexus for electricity generation and recommended that investments on renewable energy technologies make low environmental costs possible (Rehman, Cai, Mirjat, Walasai, & Nafees, 2019). Ghaffor (2020) supposed that current renewable energy status in country is not significant and needs more research and development to utilize the existing potential (Ghafoor, Rehman, Munir, Ahmad, & Iqbal, 2016). Kanwa (2020) said that a sustainable and decentralized power system is essential for energy infrastructure in Pakistan (Kanwa, Khan, & Qasim Rauf, 2020). The decentralized sources of renewables have potential to trounce energy and economic deficit of Pakistan and balance the energy, economy and environment equation.

The electricity transmission and distribution infrastructure is not updated with low access in the

[1] Uninterrupted availability and supply of energy sources at affordable rates based on long term investments for economic developments and environmental needs.

remote and rural areas. The off grid and standalone integrated energy system based on the indigenous renewable sources gear down the reliance on centralized grid system. The micro scale renewable energy projects can be drop the transmission and distribution losses after adding the optimistic effects of net-metering and bill structure. But, there are numerous key barriers and confronts hampering the renewable energy deployment in Pakistan such as outdated technology, financial risks, and market integration. This necessitates the analysis of domestic policies through the lens of international best practices so as to identify loopholes and provide necessary feedback on incentives for markets to make these functional.

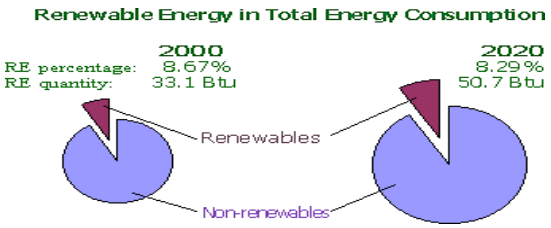
## 1.1 Global Perspective

The SDG's Goal 7 asks in endurance to worldwide right of affordable and consistent energy services and increases renewable energy share amply in the global energy mix by 2030. This opens a new sphere of opportunities and challenges to the world nations. The countries on the globe are in modification and streamlining phase of power systems to congregate the developments and decarburization in a better way. Technological advancements, business mold, social needs, and environmental obligations are the catalysts in adaption of renewables in the energy system. The accelerated drift of warming planet through storms, ice melts, drought, hunger, migration are being compelled the exigency of the need to end the age of the fossils rapidly and coined a new term "energy democracy"; as advocates of renewable energy suggest (Burke & Stephens, 2018). Global investment trend in clean and hybrid energy sources is to make better environment. Global energy consumption is being projected to elevate 30% by 2050. Hanif (2019) claimed that to accelerate the investment trend in renewable technologies for carbon free sustainable economic growth, the green bond market is being recommended as an valuable tool (Hanif, Aziz, & Chaudhry, 2019). An expansion in energy has practiced in the electrification from renewable energy sources worldwide. The renewables have tendency of protection against the erratic global energy markets.

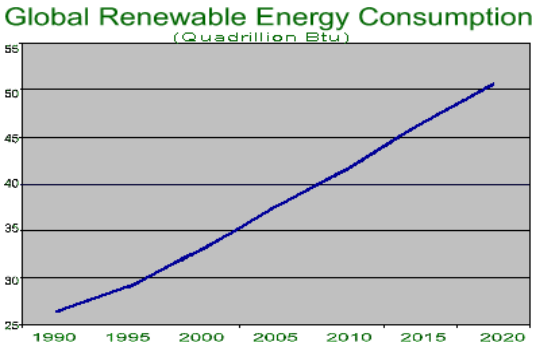
A report of the International Energy Agency has drawn a numeric sketch of region-wise energy-demand. The report explains that key energy-demand in the Asia Pacific region has an estimated rise of above 50 percent till 2050, which is more than half of world production. A new pattern of shift in trend of renewable energy use has practiced by great economic powers in the regional dynamics as well as worldwide. Mirza (2012) stated that an updated Chinese growth diagram marks 350GW hydro, 180 GW wind, 40GW biomass, and 30 GW solar Photovoltaic until 2020

(Mirza, Ahmed, & Khalil, 2012). European nation's tending to appointed ascends of renewable energy sources in energy mix during the last decades. The rationale behind this shift is that all the renewables are pro-environment, clean, safe, cheap and highly sustainable moreover are entitled to earn carbon credits under the Clean Development Mechanism. Renewable energy consumption has an advanced influence on economic growth than non-renewables. Rahman (2020) used an estimation approach in his study for SAARC region and found a positive and significant result of Bangladesh, Nepal, Sri-Lanka, and India on economic growth through efficient use of renewable energy sources (Rahman & Velayutham, 2020). Indian government arranged to establish 20GW of solar power generation in 2020. Brazil is committed to sustain and increase in present fraction of nation's existing energy up to 50% and power up to 90% from renewable energy sources by 2025. The world has experienced the growth in installation technology of wind and solar by 55% and 25% respectively (Ashfaq & Ianakiev, 2018).Countries having stable policy framework are active in renewable energy technologies deployment to promote local economic value and job creation to enhance local industry.

**Figure 1**




Source: REN21, 2018




## 1.2 Research Problem

Energy, economy, and the environment are three foremost constituents under academic discussion in developing countries. Energy is a vital role in accomplishment of socio-economic and industrial stability for sustainable development of Pakistan as the 2Es, i.e. the energy demand and economic development, are correlated in provisions of energy-mix. Pakistan's energy status is a scarce state and has energy threats. A summary of Pakistan's energy mix share has revealed that a major portion of power generation is on imported oil i.e. 32% in FY2019-20. Hydro dependence is 8%, Natural gas is 34.6%, imported LNG is on 9%, coal consumption has 13%, and the nuclear share is still 8.2% in FY2019-20 (Ministry of Finance, 2020). The contribution of renewables is just 2.4% in FY2019-20. These statistics show that the country's much reliance on the conventional fossils

energy sources, and this reliance is a crucial cause of curtail in country's foreign reserves and also increased the carbon emission in air. Although Pakistan's share in global carbon emission is just 0.8% in 2019, the global climate risk /vulnerability index 2019 by a think tank German-watch report marked Pakistan's position at number 5$^{th}$ among ten most affected countries due to extreme weather events. Renewable energy is the solution to deficient energy access and flossed power supply in Pakistan as renewable energy sources have an intrinsic nature to mitigate the harmful achieves of conventional fuel use. Luqman (2010) stated the empirical results of his study that renewable and favorable nuclear energy consumptions will bring robust effects on the economic growth of Pakistan in both small and extensive runs (Luqman, Ahmad, & Bakhsh, 2019). Farooq (2013) explained in his study that a policy for renewable energy generation on basis of renewable portfolio standards up to 50% is substantial for reduction in import dependence, fuel cost, climate mitigation and increase the investments in renewable sector (Farooq, Kumar, & Shrestha, 2013). Aized (2018) by using the LEAP model illustrated that to enter the Green Pakistan Scenario, renewable energy technologies are least expensive options in addition with least operational and externalities cost (Aized, Shahid, Bhatti, Saleem, & Anandarajah, 2018).

Pakistan's gloomy image as an energy shortage country has made vulnerable situations on the industrial and economic fronts. The government of Pakistan published a white paper in 2005 indicates to meet 10% of energy demand from the renewables by 2012 (Rafique & Rehman, 2017). The repeated policies and energy plans have been formulated by the successive governments. The first document of developing renewable energy policy was drafted in 2006 accentuated on small scale hydro, solar photovoltaic and wind projects in-country in provision of sustainable energy supply based on energy security, self-reliance, social fairness, and economic returns. Later the midterm policy framework in 2011 was formulated as an extension of previous renewable policy 2006 to get 5% of energy needs by the efficient use of renewable by 2025.

The outline of the Alternative and Renewable Energy Policy 2019 has intended "*to develop a favorable environment for sustainable, attainable and affordable renewable energy growth mechanism in Pakistan*". Pakistan's energy prerequisites are being increased swiftly up to 5% annually. The striving target of Alternative and Renewable Energy Policy 2019 is to increase the renewable share in the total energy mix of country up to 30% by 2030. The power division is now paying attention to guarantee the accessible, secure and sustainable deliverance of energy services and for the progress of natural resources and minerals. The government of Pakistan aims to ensure

energy security along with reasonable and entire support to use the local resources.

In Pakistan due to cyclic variant, there has inadequate acquaintance and technological expertise at hand for practical and realistic power generation potential from renewable energy resources. The progress relates to the renewables always mislaid as all policy gears utterly abortive to get the drafted objectives like drawn interest, assurance, and venture from private sectors. In this regard, Asif Shah (2011) identified that low awareness about the policies of renewable energy and science and technology in Pakistan as a key hurdle in attaining the sustainable targets through renewable energy resources (Shah, Qureshi, Bhutto, & Shah, 2011). The government has responsive on the development of copious potentials of renewable resources for power generation and is dedicated to make sure the sustainable power supply and energy security in the paramount approach for the public benefits by decreasing in the cost of renewable resources. The draft of the new environment-friendly and clean renewable policy has approved from the Council of Common Interest and now in implementation phase with an intentional framework to commence solid and delivery mechanism to enhance the sustainable intensification of renewable energy resources. The new policy envisaged that the renewable share will have increased up to 25% and 30% of the total energy mix by 2025 and 2030 respectively by accelerating the renewable energy resources using effective measures within domain of policy, institutional and implementation frameworks.

## 1.3 Research Question

The research aims to analyze that what are the effective actions, measures and frameworks that have been place and suggested in the Alternative and Renewable Energy Policy (AREP) 2019. The essential principle of this research is a comprehensive analysis of the alternative and renewable energy policy by classifying the main policy discourse and through text mining.

## 1.4 Research Objectives

The above research question with the focal point has subsequent objectives.

1. To assess the ***Alternative and Renewable Energy Policy 2019*** through main policy discourse on policy, institutional and implementation frameworks.
2. To understand institutional and implementation status of the ***Alternative and Renewable Energy Policy 2019*** after the 18th constitutional amendment.

3. To assess where the ***Alternative and Renewable Energy Policy 2019*** stands in comparison to SAARC countries on the alternative and renewable energy sector by using the tool of text mining.

## 1.5 Significance of Research

Alternative and renewable energy policy 2019 is being measured as a practical demonstration of energy security and renewable sources in Pakistan. The proposed study will be liberal in its propositions on the following arguments. The analysis of Alternative and renewable energy policy 2019 is critical as Majone (1977) argued that policy analysis is a key function and it happens to be indispensable when a policy under-query is non-dissected. This concept will be valid to alternative and renewable energy policy 2019, an unanalyzed document in academia. A un-scan policy may consist of various inherent imperfections and shortcomings. The study will prove as supportive material in implementation period of the policy, if revealing any inadequacy in the policy draft invidious proposal, impractical actions, and unclear roadmaps may likely be valuable for policy makers. We believe that our study will open new prospects and paths for further research (evaluation and analysis), on Alternative and renewable energy policy 2019.

# CHAPTER 2: LITERATURE REVIEW

This study is an attempt to provide the detail assessment of Alternative and Renewable Energy Policy 2019 and this chapter consists of brief discussion on previous policies (non-renewable and renewable) related to the power sector. The chapter also includes detailed discussion on different resources of renewable energy and their potential in Pakistan.

Energy use per capita (Kilogram of oil equivalent) is an indicator of prosperity in a society. The average per-person energy use is $1/20^{th}$ in developed world and less than half in developing world like Pakistan (Shakeel, Takala, & Shakeel, 2016). The government statistics point out that Pakistan is an undersupplied energy country. The rate of consumer-base electricity has increased by up to 85% during the last 20 years due to rapid urbanization (Rafique & Rehman, 2017). The current reservoirs of fossil fuels are declining and this threat demands momentous and practical measures for alternate resources of energy. In Pakistan, there is an embryonic trend of renewable energy that has magnetized the interest of academia, policymakers, and other stakeholders. A new series of studies anticipated the full potential of renewable energy capacity of power generation in the country. The upcoming panorama of renewable energy has a total potential of 170GW, which is 8 times extra than the real demand 21GW of country, a very hopeful and adequate to overcome the energy gap. Pakistan's energy system has a centerline network of grids because of hydro power generation for the agro-based economy. An off-grid electrification is a feasible option both for economic and technical aspects also non-grid distant areas for electricity supply. Many studies argue on the utilization of sustainable energy and vast resources of available renewables like wind, solar, biomass, geothermal as the ultimate source to overcome the power and economic crisis in the country.

The renewable technologies of the world have managed an established prove of cost-effective procedures to distinguish with the usual relic energy. On the global index, solar installation plus wind-power tools have practiced amplification to the development of solar and wind up to 60% and 30% respectively. The US governments and the World Bank are helping Pakistan in the geological solar-energy as well as wind resources map study (Ashfaq & Ianakiev, 2018). Calculations of solar-energy map conducted by US-National Renewable Energy Laboratory (NREL) and German Aerospace Centre Institute have formulated almost 1600 (GW) Pakistan's solar power potential. Practicability for the grid connection photovoltaic energy system in a rustic area of Pakistan has done with the proposal that government assistance and encouragements can extensively force the

conversation of users to solar photovoltaic technology in the rural belt of Pakistan (Rafique, Rehman, & Alhems, 2018). In the context of wind generation, a similar study of geographical wind power density maps for Pakistan has conducted by the US-National Renewable Energy Laboratory (NREL) and Denmark Technical University (DTU) and optional that Pakistan has 350 GW wind power potential as consumption for this titanic new wind power reserve and wind turbines due to explicit climate conditions of Pakistan. Baloch (2019) conducted a technical study by and suggested a hybrid energy solution of power crisis in Pakistan (Mazhar Hussain Baloch et al., 2019). Faroouqi (2014) revealed in his study by using estimation approach that Pakistan has feasible potential of 50GW from wind and 30GW from Hydel (Farooqui, 2014). There are several unaddressed questions in literature based on technical and practical grounds of wind and solar power generation due to limited knowledge and bottlenecks of national transmission and distribution system. The resourceful consumption of accessible and domestically developed renewable expertise may play an imperative part to establish a long term sustainable energy security of Pakistan. Alternative and renewable energy policy 2019 is comparatively a new subject in Pakistan. Available literature has focused on technical and scientific aspects and less notice has been paid on the policy angle of this public issue. Historically, Pakistan has strived to focus on developing the capacity to produce alternative energy sources. A large number of Pakistani companies are producing alternative energy tools. Pakistan lacks research on the pros and cons of the alternative and renewable energy. Thus, this research aims to contribute a meaningful addition to understand the discourse of renewable and alternative energy policy in Pakistan.

### 2.1 Renewable Energy Perspective

The energy acquired from natural resources like sun, wind, geothermal, tidal, and biomass is commonly identified as renewable energy sources. From the initiate of civilization these resources were in significant use of man-kind as capable energy provisions with utmost zero Green-house gas emissions and made obtainable universally irrespective of geological and geo-political borders. Resource assessment is paramount factor in determination of renewable energy technologies and renewable resources in country. For accurate and reliable data, an alternative technique of remote sensing is considered as best for data collection (Sheikh, 2010). Farooq (2019) in his study suggested that renewable energy depends upon technical, geographical, economical and practical potentials of renewable resources (Farooq et al., 2019). Khan (2018) claimed that these plentiful renewable resources are ample to accomplish the energy demands of the whole world and to

decrease carbon emission (Khan, Ali, & Ashfaq, 2018). According to energy year book 2019-20, installed capacity of renewables is from solar 400MW, wind 1333MW, and bagasse 500MW with cumulative capacity of 2233MW. The generation from renewables is 4403GWh.During PSDP 2019-20, projects having 688 MW from renewables have been added for power generation.

### 2.1.1 Solar

Pakistan is located in the region of lengthy sunshine's days with maximum opportunity of gaining advantages from solar technology. Pakistan yearly receives $16x\ 10^{14}$ kWh of solar irradiance. A study of solar power generation mapping argued that in Pakistan the solar photovoltaic production has utmost in the northeastern areas, then the south- western and the south-eastern districts (Ashfaq & Ianakiev, 2018). Solar energy has plentiful availability and wide distribution, and this may have an ability to improve the economic incomes of the people of secluded areas and trim down poverty particularly in the Sindh and Balochistan provinces. Balochistan has a bulk of national resources also comfortable in solar power with a standard daily global insolation (incident solar radiation) of $21MJ/m^2$ per day has average yearly sunshine's period from 9-10 hours/day. The numeric insolation of Balochistan is being noted as high on the globe (Khalil, Khan and Mirza, 2005). As each day worldwide energy emission near 25 $MJ/m^2$, 27 (85%) has accessibility in this region successive days. This situation is a perfect model for the PV as well as new solar power technologies (Mirza, Ahmed, & Khalil, 2012). The economic survey 2019-2010 confirmed that National Assembly of Pakistan is the world's first solar assembly as a 2MW solar system has installed in 2016 by the Chinese government as friendship act (Kamran, 2018). World Bank solar DHI map has pointed that the Sindh, Balochistan and desert areas of the Punjab have high solar budding. Shakeel (2016) said that the worldwide solar photovoltaic capacity has increased by 60% from last ten years. The experts of renewable energy have claimed that Pakistan has capacity of 1600GW power generation per annum from solar photovoltaic cells. A study used the Renewable Energy Focused Input and Output model to analyze the employment creation potential of renewable energy technologies (Hondo & Moriizumi, 2017). Alternate energy development board issued 8 letter of intent (LOI) of 1420MW to Punjab, 17 LOI of 1400MW to Sindh, and one LOI of 50MW to KPK in December 2017.There are four solar power projects each have 100MW capacity with combined capacity of 400MW, have started commercial operation. The solar PV projects of 450 MW has completed in 2016-17 as decline in the PV technological cost. Although the solar market is nascent in Pakistan however, this project is labor-intensive as it has offered more than 15500 jobs to local communities (IRENA, 2018). The report highlighted solar sector market and bulk of employment development.

Table 1 show that by accelerating the deployment rate in solar PV technology, the thrust of labor force will open job market.

**Table 1: Jobs in Pakistan Solar Market by market segment**

| Sector | Residential | Commercial | Utility | Total |
|---|---|---|---|---|
| **Manufacturing** | 400 | 100 | 100` | 600 |
| **Supply Chain** | 1000 | 500 | 100 | 1600 |
| **Installations** | 4000 | 1600 | 300 | 5900 |
| **Design** | 100 | 300 | Minimal | 400 |
| **Business Development** | 4000 | n/a | n/a | 4000 |
| **Project Development** | n/a | 1200 | Minimal | 1200 |
| **Operation Management** | 1000 | 600 | 200 | 1800 |
| **Total** | 10500 | 4400 | 700 | 15500 |

**Source; IRENA (2018)**

**Solar Upfront Tariff**

In January 2015, NEPRA approved the upfront generation tariff for solar PV power plants up to 10MWp and greater than 1MW. The tariff has adjusted on the geographical differences in solar irradiation and divided Pakistan in two zones.

**North Region:** Rs. 22.0197/kWh for year 1-10 and Rs. 9.1325/kWh for year 11-25.

**South Region:** Rs. 21.1138/kWh for year 1-10 and Rs. 8.7568/kWh for year 11-25.

**Source IEA Database (2015)**

Pakistan forced the feed-in-tariff scheme for solar power in 2015. The scheme offered different payment levels for solar projects up to 10 MW of 25 years length. The feed-in tariff has variations based on the region and capacity. Per project remuneration is for 25 years but after the first initial years of generation period the tariff is lower. A high tariff has applied on Northern region because of low irradiance level and capacity factor less than 17%.

**Table 2 : NEPRA Solar Upfront Tariff 2015**

**North region: Feed-in tariff levels from 22nd January 2015 expressed in PKR/kWh**

| Capacity | Remuneration for years 1-10 | Remuneration for years 11-25 |
|---|---|---|
| <20 MW | 19.2 | 8.6 |
| 20MW – 50MW | 19.0 | 8.58 |
| 50MW – 100MW | 18.8 | 8.55 |

Source IEA Database, (2015)

**South region: Feed-in tariff levels from 22nd January 2015 expressed in PKR/kWh**

| Capacity | Remuneration for years 1-10 | Remuneration for years 11-25 |
|---|---|---|
| <20 MW | 18.4 | 8.25 |
| 20MW – 50MW | 18.2 | 8.23 |
| 50MW – 100MW | 18.0 | 8.19 |

Source IEA Database, (2015)

### 2.1.2 Wind

A study of wind resource mapping showed that Pakistan's eastern and western areas have maximum wind power generation because wind turbines supply extra power within anecdotal wind speed relative to the high pace circumstances (Ashfaq&Ianakiev,2018). A case study on future perspective of wind energy in Pakistan theoretically proved that southern part of country is more favorable and suitable for future windmill implementation (Mazhar H. Baloch, Kaloi, & Memon, 2016). A comprehensive data report of Pakistan Metrological Department has defined a coherent and viable wind hall situated along the coastal belt of Sindh having an average wind speed is 10m/s at an altitude of 90 meters, provides a base line for utilizable wind power generation of 50,000MW capacity (Qamar,2009), (Mirza et al.,2012). Another study highlighted the importance of wind energy as an alternate source in long term solution of energy crisis in Pakistan (Zameer & Wang, 2018). A detailed wind-map study of National Renewable Energy Laboratory USA in the teamwork of USAID and Alternate Renewable Energy Board (AREB) established in the report that, Pakistan has the potential of 300,000 MW of wind energy, but this map ignored technical and economical

limitations. AEDB has issued 45 LOI of 1900MW capacity. According to AEDB 15 projects having 600MW capacity have generated power and added in national grid. Sindh energy department has issued 23 LOI of 1700MW capacity. There are 18 wind power projects at different sites each has generation capacity of 50MW with a cumulative capacity 900MW have installed with upfront tariff regime. At present 90 countries have developed the use of wind power generation and China enjoys a lead in wind power with 33.6% of global wind share having generation capacity of 145,362 MW (IRENA, IEA, & REN21, 2018). A study conducted by the Global Wind Energy Capacity on comparison of Pakistan and India wind energy power generation potential and found that Pakistan has remarkable wind power potential but no major spark has been exposed on this account. India has 25,088 MW wind generation capacity with 5.8% of global share in wind energy shows the Indian effort in the installation and operation of wind power projects that stands Indians the world's fourth nation.

The cost of wind production depends on wind speed and size of turbine. Wind energy is adopted as capital-intensive technology. Wind power cost includes capital cost and variable cost.

**Wind upfront tariff**

The net annual capacity factor defined by NEPRA under the current wind project upfront tariff is 35% and generation exceeding 35% is subject revenue sharing as following

**Table 3 : Wind upfront tariff**

| Capacity Factor | Chargeable Tariff % |
|---|---|
| 35% to 36% | 75% |
| 36% to 37% | 80% |
| Above 37% | 100% |

**Source; NEPRA**

### 2.1.3 Hydro-power

Energy production from water motion is hydro generation and is evident as the largest renewable source. Its share in worldwide power generation is 85% according to report of REN21, 2018. Hydro power is the cheapest and promising power generation source and Pakistan's northern areas are affluent in hydro power resources with small and large controllable waterfalls in abundance with potential are up to 300MW. The canal net work in Punjab with low head and high flow has an estimated potential of 350 MW. Punjab government with collaboration of the Punjab power development board is sustaining and issued letter of intent to 12 projects of 250MW capacity. A full potential of 45GW development project has not benefited by the Gilgit-Baltistan due to lack of

connection to the national grid. Khyber Pakhtunkhwa energy department estimated several off-grid small hydropower projects having installation capacity of 150MW.

### 2.1.4 Biomass/Bagasse

Traditionally, form thousands of years, biomass has been used as a primary energy source by man. International Energy Agency classifies biomass as macrobiotic decaying material obtained from living organisms offered for renewables. Biomass wraps agricultural, industrial and forest residue, bio degradable solid waste. The country has a great latent of electricity generation from the biomass as agro-industrial residue. The global use of biomass as bio-energy production is probably to increase in the coming era as an assessment to attain 3000TWh by 2050 (Shakeel et al., 2016). A report of IRENA tales that country's biomass feedstock from industrial and agricultural residue is 25 million tons per year. In Pakistan, the biomass incorporated from agriculture residue like wheat straw, trash of sugar cane, and from industry like maize husk, poultry debris, bagasse, animal manure, and wood. A single sugar industry (83 sugar mills) has a huge potential of about 3000 MW electricity production. Only 4 sugar mills have the getting capacity to generate power about 145 MW by December 2016 and 216.4MW capacity plants have started commercial operation in 2018. The government of Pakistan and the private power infrastructure board (PPIB) has committed to adopt a co-generation policy on a fast-track mechanism for electricity growth from biomass, as it is clean and renewable has a positive correlation with environment protection, ecosystem provisions, and biodiversity conservation. Shakeel (2016) claimed in his study that Pakistan has full potential of 36 million KWh generations based on biomass available resources daily as estimated potential of 1800MW from bagasse and 550MW from solid waste. Municipal waste also has power generation potential. Yasar (2017) explained the results of a case study of rural Punjab that health and socio-economic indicators of rural households have shown significant improvements by the installation of biogas plants (Yasar et al., 2017). A study of World Bank points that in Pakistan per day 30000 tons of solid waste produced which has the 400MW power generation capacity. The cost of electricity generated by the hybrid off-grid system (solar PV/biomass) is partially cheaper than the conventional grid generated electricity (Shahzad et al., 2017).

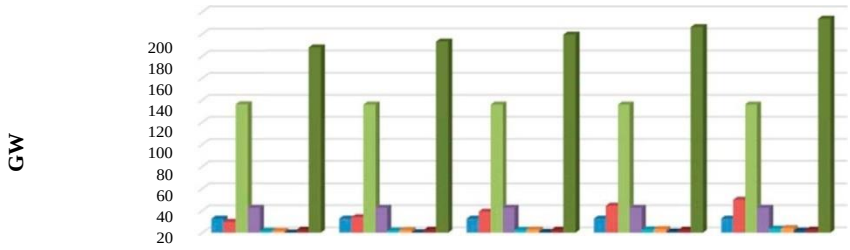
### 2.1.5 Geo-thermal

Geothermal energy is heat present under-earth in hot leaps and geysers types. It is highly uncharted and unexplored resource in Pakistan with no comprehensive estimation. Pakistan is

loaded in geothermal energy reserves with heat level 35-175 $^{0}$C, mainly found in the Himalayas, sections of Karachi, and mount range of Koh-e-Suleman. Although in excess of this potential source, no active and solid steps have never been taken to cater energy from this source (Zafar, UrRashid, Khosa, Khalil,&Rahid,2018). Pakistan has commercial vulnerable geothermal resource. Geothermal projects commercially viable by creation of net positive value over project's economic life for investor (Abbas, Ahmed Bazmi, Waheed Bhutto, & Zahedi, 2014). Pakistan is a member of Global Geothermal Alliance since December in 2015 and adopted the Florence Deceleration in October 2017. Pakistan showed international commitment to extend geothermal power generation and 100% increases in geothermal heat by 2030.

For highly accurate, real-time and validated data of solar, wind, biomass mapping in Pakistan, the Alternate Energy Development Board (AEDB) has installed different weather stations funded by the World Bank's Energy Sector Management Assistance Program (ESMAP).

**Figure 2**




| | 2010 | 2020 | 2030 | 2040 | 2050 |
|---|---|---|---|---|---|
| Wind (grid connected) | 13 | 13 | 13 | 13 | 13 |
| Solar PV (DCNT) | 10 | 14 | 20 | 25 | 30 |
| Solar PV (CNT) | 117 | 117 | 117 | 117 | 117 |
| Solar thermal (CNT) | 23 | 23 | 23 | 23 | 23 |
| Biomass (field residues) | 2 | 2.5 | 3 | 3.3 | 4 |
| Biomass (animal waste) | 2 | 3 | 3 | 3 | 4 |
| Biomass (MSW) | 0.1 | 1 | 1 | 1 | 2 |
| Small Hydro | 3 | 3 | 3 | 3 | 3 |
| Total | 170.1 | 176.5 | 183 | 188.3 | 196 |

A projected technical prospective of deferent renewables resources of energy for power generation in Pakistan, 2010–2050

### 2.2 Policy Attempts in the Development of Renewable Energy Policy

A policy is an inclusive document to legalize and regulate the market to the provision of supplies and commodities to the public on affordable and sustainable rates to maintain economic stability. The evolution of policy-making will enhance the impact of renewable energy in the near future.

Mirjat (2017) said that power and energy polices of Pakistan have issues of policy inconsistency, implementation shortcomings and lack in integrated energy planning (Mirjat et al., 2017). In 1985, the federal government first initiated a private policy as a preface step to attract the private sector

investments in electricity generation to overcome the monopoly of government organizations and unlock the alternative of renewable energy search. For this purpose government allocated the finance of Rs 15 millions in its 4th five-year (1970-1975) plan in research of viable renewable energy technologies like solar, wind and biogas (Zafar, Ur Rashid, Khosa, Khalil, & Rahid, 2018).

**2.2.1 Private Power Policy Framework 1994 and 1995 Hydel Power Policy Framework** In the year of 1994-95, first official and comprehensive power policy of Pakistan was introduced to allow the private owned power generation projects in country, with salient features of upfront tariff of US cent 5.91/KWh for project life announced by the government through private sector resource mobilization, attractive framework for domestic investors to accelerate power generation capacity in country up to 3000MW. As it was investment oriented policy, the government by using public private partnership (PPP) offered 'Build, Own and Operate (BOO) model to the private investor. The purpose to establish Private Power and Independent Board was to assist the one-window operation. This policy was known as reorganization of power sector into autonomous bodies and a fusion of incentive, consent and procedure. The government gave the incentives and facilitate the investors by given them the purchase, fuel supply and bulk power agreements. The policy assured fixed payment "capacity price" to IPP's as per terms of Concession Agreements despite electricity generation, there was no guarantee for purchase of a specified amount of power. The policy also included different tax and surcharge exemptions to attract the investors like income tax, customs duties and sales tax on imported equipments. This policy was an important shift in diverse energy resource in country. The policy was partially successful as establishment of an indicative bulk tariff with indexation mechanisms for fuel and inflation, attractive financial and fiscal incentives and standardized security package. The policy had inconsistent implementation mechanism in terms of capacity and location, fuel selection and technology. The policy had no clear mechanism for government to prioritize projects. The basis on which projects were selected and accorded attention was not transparent and subject to political influence which led to perceptions of corruption. The policy failed in case of hydro power plants and proved to be a liability and trap for government. A key hitch of this policy was use of furnace oil by maximum number IPP's plants and a small number of power plants use natural gas resulted increased generation cost and pollution (Rafique & Rehman, 2017). There were 15 projects of 3100MW capacity with 3490 million US dollar investment under this policy. This policy document has paid no attention towards the alternative and renewable energy options.

**2.2.2** The new policy that was named Policy for **New Private Independent Power Projects** instituted in July **1998,** in direction towards the competitive power market. The policy framework was based on setting the minimum level tariff on competitive process. Bidders were supposed to be tendered by international competitive bidding on power tariff basis. The tax incentive was same as in 1994-95 policy but this policy did not attract investments because of tight procedural risk. For promotion and adoption of renewable energy options in country, this policy permitted the unsolicited bids for renewable sources and small hydro plants devoid of the requirements for competitive biddings.

**2.2.3 Policy for Power Generation Projects 2002** was in action with the key objectives of utilization and encourages the indigenous resource exploitation. Policy was more investor friendly on unsolicited proposal actions and competitive bidding was introduced. The projects of more than 50MW were in federal control and less than 50MW were provincial. The generation target of this policy was 500MW from renewables by 2015 and 1000MW by 2020 through pubic private partnership giving representation to the provinces in the private power infrastructure board. Under this policy, there were 13 projects of 2934MW having investment of 3248 million US dollars. This policy showed thrust in development of indigenous and renewable based power projects.

### 2.2.4 Energy Security Action Plan 2005-2030

To attain the basics of Pakistan's Vision 2030 of consistent and quality energy supplies, this plan was approved in 2005. The key objective of this plan was to enhance energy supply by optimal diversification of energy mix and utilize the indigenous and renewable resources to expand the combined share up to 36% by 2030. Due to public resource constraints, it has emphasized for public private partnership to promote stability, supplies and pricing.

**2.2.5** The Alternate energy development board drafted **Policy for Development of Renewable Energy for Power Generation** in 2006. It was the first comprehensive energy policy document focused on development of renewable energy sources and technologies like solar, wind and small hydro projects up to 50MW in country. The bio-mass and bio-fuels projects were excluded in this policy. The policy framework was intended to shore up the macro and micro level renewable energy projects. The policy targeted to increase the share of renewables up to 10% in the total energy mix by 2015. The policy scheme was to enhance the deployment of renewable technologies by making possible support for the investors through incentives and to carry out extensive measures to open comprehensive renewable energy market for private sector. The AEDB offered

project initiation permit referred as “letter to intent” to private sector project developers. The policy framed a mechanism to assemble local investment strategy in order to foster the domestic technical skills and job prospect. Like pervious policies, to attract the investments there were also tax and duty exemptions on machinery and equipment of renewable projects. IPPs were permitted to raise the domestic and foreign funding mutually (Mirjat et al., 2017). The leading textures of this policy as short term framework were:

- Permission of investors from the private sector for independent power projects and off grid power projects.
- Investor was being permitted to generate power at one place and be given the same to another place on the grid. The generation cost and the transmission charges were liable to the investors.
- Policy made obligations to the Central Power Purchasing Agency to purchase electricity on or after qualify renewable energy projects.
- With arrangements on net basis, permit the net metering and billing.
- Tariff determination based on transparent principle.
- Policy fairly protect an investor from the peril of resource inconsistency.
- To avoid the GHG emission, introduce the carbon credits in renewable projects.

**2.2.6 National Energy Conservation Policy 2006** was initiated as a policy guideline to increase the end use energy conservation and efficiency pertaining to energy, economy and environment. On the renewable front, the policy focused on promotion of cost effective and feasible renewable resources and technologies like solar thermal, solar water heater and solar desalinates. The policy highlighted the development and deployment of biogas units to bring the livestock farms and diary industry in the loop. The policy objectives included to foster and develop energy conservation by regularization of total energy management program for promotion of sustainable growth.

### 2.2.7 National Policy for Power Cogeneration by Sugar Industry 2008

The Co-Gen policy was an independent and standalone policy notified in January 2008. The Co-Gen power projects based on the biogases a stringy residue of sugarcane and highly environment friendly. Pakistan is the world’s fifth largest sugarcane producer. More than 90 sugar mills in

Pakistan have potential to add power generation of 3000 MW in the national grid. Co-Gen is being considered as an efficient energy production system of both electricity and heat using single fuel source. The initiative of the Co-Gen policy was reduction in the cost of energy and pollution under government clean and energy secure plans. The rationale of Co-Gen policy was to make sugar industry viable to add power to national grid during the winter season (November- February) when the Hydel generation at its lowest using bagasse as a major fuel. The incentives offered in this policy for Co-generated projects were same as for IPPs in renewable policy 2006.

### 2.2.8 National Energy Policy 2010-12

An era of load shedding and energy crisis in country compelled the government to devise a short energy policy in April 2012. The policy mainly focused on energy conservation plan and short term electricity generation through Rental Power Plants as well as investments by IPPs.

### 2.2.9 Mid-term policy 2011

This policy was an extension of short term strategy of renewable energy development 2006. The aims of med term policy were to made correspondence of the actions among various government bodies. The policy introduced incentive plans and opportunities for investor's attraction to increase the alternate and renewable energy deployment and promotion. The policy made comprehensive guideline to attain optimization level of the alternate and renewable energy projects explicitly in the underdeveloped and remote areas through community participation giving socio-economic benefits like income generation. Special focus was made on increasing the institutional and technical capacity of renewable energy technologies in country. Policy recommended to increase the budget of research and development for promotion of research in renewable sector as well as to develop domestic manufacture market of alternate and renewable energy.

### 2.2.10 Policy Framework for Power Cogeneration Biomass and Bagasse 2013

On March 6, 2013 Economic Coordination Committee (ECC) approved an amendment in the mid-term renewable energy policy 2011 by inclusion of biomass, bagasse, waste to energy and bio-energy as sources of renewables. The amended term named as "Framework for power generation 2013 biomass and biogases." This was applicable on all high pressure (60 bars) cogeneration projects operated on biomass and bagasse specially made after January 31. The power producers under this framework have given the choice of being established the project as a separate entity or as part of existing sugar mill. NEPRA on the basis of per unit energy delivered to the grid held

responsible to regulate the upfront tariff of Co-Gen projects. This framework gave the choice of opt upfront tariff to the power producers. The power producers were being offered electricity to the respective distribution companies if the interconnection cost and grid station upgrades have acquired by respective distribution company. The framework made mandatory to power purchaser of all offered energy consumption and in case of failure in all consumption, the plant will have to dispatch and sold energy to power purchaser.

### 2.2.11 National Power Policy 2013

This policy has a vision to develop the efficient, consumer centric power generation, transmission and distribution system to attain the robust sustainable cluster and affordable energy targets. The policy has several goals like to remove the supply and demand gap, reduction in generation cost by upfront tariff and competitive bidding, increase in efficiency by reducing transmission and distribution losses and eradication of non-technical losses, reduce in subsidies, promotion of energy conservation culture, to improve energy governance by decrease in time of decisions making process and increase the financial collections to improve the efficiencies of utilities by privatization of distribution companies. To achieve the aforesaid policy targets, the policy tools of efficiency, competition and sustainability were used. The policy emphasized on switching to indigenous cheaper fuels like coal and renewables. The impacts of social development and prosperity in country measured policy as a successful in accomplishment of its maximum targets. Planning and development division of Government of Pakistan presented energy vision in 2014 with major policy input of unremitting supply of clean and affordable energy.

### 2.2.12 Net Metering policy for Solar PV and Wind projects 2015

On September 1$^{st}$, 2015 the National Electric Power Regulatory Authority NEPRA approved a net metering policy. The policy draft said “Solar PV and wind generators of 1MW capacity are allowed to sell back the produced electricity to the national grid. The price of purchased electricity from the distributed solar and wind production units shall be the same as the off peak electricity rate charged by utility companies for electricity sold to distributed solar and wind generation units. The eligible generators of residential, commercial and industry scale owners may take benefits under this policy”. Up to March 2020, more than 2300 licenses on net metering have been issued of 34MW capacity (Ministry of Finance, 2020). The aim to implement net metering in power shortage era is an injection merely for small scale solar PV. The enterprises and residential sectors are going to get advantages, by trading off surplus energy generation to their solar PV mechanism

and add back to the national grid. Even though, a small contribution can be helpful in mitigation of electricity supply-demand deficit.

### 2.2.13 Power Policy 2015

This policy was a replacement of Power Generation Projects Policy 2002 and offered profitable and better business incentives for thermal and large hydro development greater than 50MW investors through simplified process under public private partnership projects. The incentives included tax-free corporate income with no turnover, with-holding and sale tax. The other incentives included only 5% concessionary duty on imported plants. The government pledged to protect the power purchasers against any change in laws, taxies and provinces duties. The policy had objectives to enhance power generation capacity using cheap, indigenous and clean resources at low cost with the association of all relevant stakeholders.

### 2.2.14 Power Policy 2019

This policy has the portfolio of National Electricity Policy. This was firstly named as Alternative and renewable energy policy but strangely enough it was unexpectedly renamed as National Electricity Policy 2020. The renewable target of 25% and 30% share in Alternative and Renewable Energy 2019 has not been mentioned in this power policy.

## 2.3 Institutional Framework

The institutional framework consists of leadership and managerial support along with technical expertise and skilled workers in order to implement the strategic goals of policy. The problematic fact of power sector is that different entities and bodies have controlled over the energy sector with their own policies and dealings and also has no central controlling governing body. The nexus of institutions related to energy and power are Ministry of water and power with 20 subsidiaries agencies, Energy unit of Ministry of planning and development, Ministry of petroleum and natural resources with 15 subsidiaries agencies (Rafique & Rehman, 2017). This multipart institutional nexus complicates the energy set-up in Pakistan.

- Technical and Research
- Financial
- Generation, Transmission and Distribution

Different government and academic departments, and agencies are supporting and responsible for

the development, promotion, and research in renewable energy technology in Pakistan from last few years. This section includes discussion on the roles and responsibilities of different departments.

**Government Institutions**

**2.3.1 National institute of silicon technology;** A first institute established in 1981 with aim to research development and awareness in solar technology mainly on mono crystalline silicon based solar cell.

**2.3.2 Pakistan Council of Appropriate Technology;** The second institute in the promotion of renewable energy technologies was setup in 1985. The sole objective to establish this institute was to assist in the development of technological expertise in renewable energy with mainly focused on wind projects and small Hydel power projects. Initial research focused on energy, food, habitat, and health by water desalination and solar cookers.

**2.3.3 Solar Energy Research Centre;** Established and works under ministry of science and technology with the aim to search various methods to use solar energy in country. The applications developed by SERC are solar thermal power generation, solar desalination, and solar air condition.

**2.3.4 National Engineering and Science Commission & Solar Energy Centre;** In 1980 both these institutes were established for solar energy technologies development in country. SEC designed solar flat plate water heating system and for purification of drinking water, a water desalination plant of 500 gallon/day capacity was installed near Gawadar.

**2.3.5 National Commission for Alternative Energy;** Established for promotion of renewable technologies.

**2.3.6 Centre for Energy Research and Development;** Situated in University of Engineering and Technology Lahore, to reinforce the energy sector by replication of energy policy, technology, and practices for sustainable development in Punjab. It provides trainings, advisories and research in policy, management and technology related to energy for public and private sector (Kamran, 2018).

**2.3.7 Pakistan Council for Renewable Energy Technology** founded in 2002 after merging of above two departments with the cooperation, organization and encouragement in research and development of renewable energy activities of solar (thermal and PV), wind energy, biogas and small Hydel. Currently works under ministry of science and technology. The intention to establish

PCRET is the development and deployment of clean, green and eco friendly energy in Pakistan and also provides energy training to create renewable energy culture. The massive use of renewable technologies in domestic and industry is success of PCRET. The achievements on PCRET credit are distribution of more than 97,000 cook stoves, 150 solar cookers and dryers, installation of 150 wind turbines for power supply to 450 houses. The renewable energy training centre of PCRET is manufacturing and designing different applications and systems e.g. organic solar cells, low power solar lights, silicon wafers, home light systems, street lights, solar fountain, solar mobile chargers, community size solar dryers, and solar electrification for remote areas.

**2.3.8 Alternate Energy Development Board:** In 2003 this organization was established with the core objective to work on design and frame of policy purely for renewable energy sources along with technologies covering all solar, wind, biogas, municipal waste, small hydro and geothermal. The major task of the board is to build up strategy, policy and plan for the renewable and alternate energy consumption to conquer the milestones set by the federal government. The role of the board is as a coordinating body for profitable use of the alternate and renewable technologies. The board acts a forum in evaluation, monitoring and certification process of renewable projects to smooth the progress of power generation. The board has also active membership of International Solar Energy Society and World Wind Energy Association and has collaborations of international donor agencies e.g. ADB, USAID, and UNDP in fund collections for promotion, deployment, and implementation of different renewable energy projects. The board has taken the series of radical measures for investment attraction and renewable technologies deployments. AEDB installed solar panel having generation capacity of 65MW of energy in Pakistan. AEDB has initiated the installation of more than 20,000 solar heaters in villages and far-flung areas of Gilgit-Baltistan. Electrification of more than 1000 villages has carried out by solar thermal power plant. The board identified new wind and solar corridors and resource assessment is in progress. The board amended the national grid code of wind projects. The AEDB has legislative foundations through an act of Parliament passed in 2010.

**2.3.9 National Energy Efficiency and Conservation Authority;** It was established as an autonomous agency under the federal ministry of planning and development in 1986 through federal government resolution. In 1993 the authority ass transferred to ministry of water and power. In 1997 its status had changed as an attached department under the ministry of environment but in 2011 the department was again transferred to ministry of energy (power division). It serves as a focal body with mandate to initiate plan, develop data base prospects, catalyzes and trigger all

activities related to energy conservation in country.

### 2.3.10 National Electric Power Regulatory Authority

A regulatory body instituted by NEPRA Act 1997 with the structure, roles and responsibilities. Its mandate and responsibilities are licenses issue to IPP's for power generation, transmission and distribution performance standards monitoring, and determining and controlling tariff rates based on all cost and offered financial incentives. For promotion and function of renewable sector, NEPRA has issued regulations e.g. net metering.

### 2.3.11 Energy Wing, Planning Commission

The wing is engaged in processing and approval of energy sector projects, resource and funds allocation under PSDP, It has core responsibilities of coordination on short, medium and long term, energy policy and plan formulation, review, implementation, legislation and regulations.

**Private Organizations**

Number of universities and private organizations are actively participating with modest pace in research and development work of renewable energy technology.

**Private Organization**

- Grid Solar and Sun Power Systems, Karachi
- Economia, Firex Solar and Hagler Bailey Islamabad
- Wind Baron and Saghal Electronics, Rawalpindi
- Siemens Solar, Lahore
- Sunpack, Faisalabad
- Alternate Energy Group, Advanced Engineering Research Organization, Wah

**Academia**

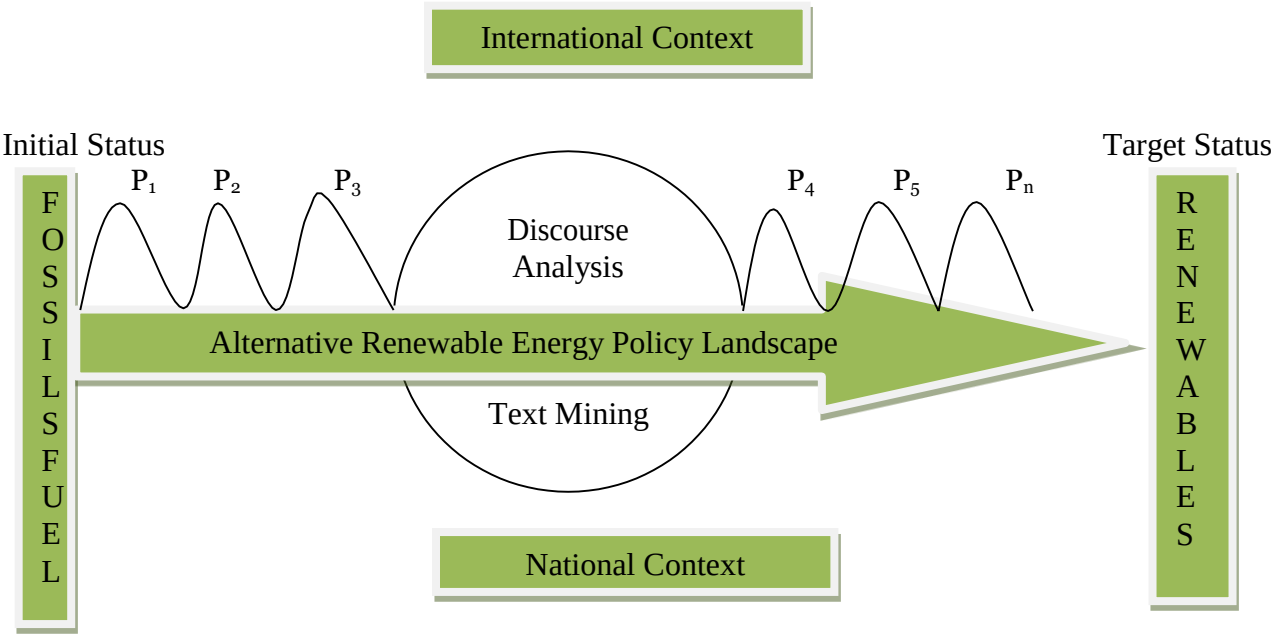
- National University of Science and Technology (NUST) Rawalpindi
- University of Engineering and Technology (UET) Lahore and Peshawar
- Comsats Institute of Information Technology (CIIT) Lahore
- NED University of Engineering and Technology Karachi

# Chapter 03: METHODOLOGY

## 3.1 Conceptual Framework

The framework below presents our approach to understand and investigate best case for Pakistan. Every country starts with an initial condition that is to bridge the demand gap with the quickest source of energy generation i.e. the fossils fuels. This can be due to various reasons as discussed above (climate variations experienced specifically in the case of hydral source of electricity, lack of cheaper source of electricity generation or the ready availability of natural resources i.e. fossils). Nevertheless, the international obligations as well as international responsibilities (i.e. concerning climate change) compels nations to strive for best case scenario i.e. to switch to more sustainable sources of energy.

**Figure 3**




**Policy; Objectives, Actions, Tools, Constraints, Players, Instruments, Interventions, Integration**

**Complied by author**

Now each country dictates its own terms when it comes to options as well as the momentum to achieve the desired targeted state of affairs. This study adopts the qualitative analysis approach, conducting text mining and discourse analysis, to investigate the best path. With the given tools the study elaborate the concerned policy by assessing its objectives, actions, tools, constraints, players, instruments, interventions and integration, to understand the chances of success and to pin point the elements of concern. The discussion below further elaborates the concept and approach.

## 3.2 Research Method

The scheme of this part is described in a way that, the first part consists of important methods of research plan. Second part provides a comparison of global renewable energy policy to Pakistan alternative renewable policy through the discourse analysis and also the explanation of why discourse analysis is suitable for this research. The last part explains the methodology of this study which is based on Hajer (2006). Qualitative method is realistic to gather and conjecture data for analytical study to be conducted of newly announced policy.

### 3.2.1 Methodologies Background

There are three key approaches being used to conduct research namely qualitative, quantitative and comparative methods (Sung 2011). A qualitative approach as a distinct research stratagem is generally accentuation of expression instead of quantifying and analyses of collected data (Bryman & Bell 2007).

The objective of the public policy is an effort of guidance and organization to attain the desired targets completely or partially as a part of socio-economic growth of nation. A policy initiates with a defined baseline and a strategy of how to achieve the desired solution along-with a trail toward attaining targeted aims. Policy tools and instruments are helpful in the implementation of policy actions by the collaboration of policy players (stakeholders). The national scenario of public policy is in isolation and it should gain an independent status up to the international standards especially in terms of technology, infrastructure, finance, and market.

The global renewable energy policy developed by the international renewable energy agency (IRENA) is a network of renewable energy policies agenda that has adopted by many States as renewable energy portfolio standards (RPS). The policy framework of global renewable energy has ambitious target areas of power, transport, heating, and cooling. To unlock the potentials of renewable energy and to gain the diverse benefits from renewable energy resources the policy framework mainly scopes on reliable and resilient energy, job creation through green growth and reduced pollution as international climate goals. This document is a benchmark of this study to analyze the draft of Alternative Renewable Energy Policy 2019. This study is designed to conduct a comparative analysis of South Asian renewable energy policies and Pakistan renewable energy policy in 2019. This is qualitative to assess the policy landscape to attain the desired targets in the renewable energy sector.

To analyze any public policy, a number of techniques are being adopted. A few key frameworks

and methods in policy analysis are Framework Analysis (FA), Cost-Benefits Analysis (CBA), Policy Process Analysis (PPA), and Discourse Analysis.

Framework analysis is opted when addressed to the specific research questions in time constraints with a pre-arranged sample. Framework analysis deals only with theories without concern of interpretation and argumentation of data. Cost-benefit analysis merely deals with the economic access of the total cost of a project or program, whereas the policy analysis focuses on the proper steps from initial to final of the policy process. The research methodology merely depends on the feasible effect of the policy problem in policy study. This study has opted discourse analysis of Hajer framework as a valuable technique to inspect the language and text to reflect on new prisms of Alternative and Renewable Energy Policy 2019 while taken focal insights from key informants.

### 3.2.2 Discourse Analysis

The term "discourse" is used as an exchange of discussion or dialogue. Various academic disciplines have developed different modes of discourse analysis. The discourse analysis was first introduced in linguistics by Pinner 1995 and further Michel Foucault in 1969 worked on it and opened new era of discourse analysis. Norman Fairclough was famous as founder of critical discourse analysis. Discourse analysis is qualitative approach in domain of social sciences to evaluate the standard documents and manuscript like policy drafts in facts more over systematic perception (Peräkylä,2005). This process has appropriate settings in analysis of data consist of media-contents, policy documents or ecological groups (Kurz et al., 2005).

A discourse analysis involves methodical awareness to both text and context (Gasper & Apthorpe, 1996). Scrase and Ockwell (1999) strongly believe for discursive approach of policy analysis and support the linguistic importance in policy framing in public arena and construction of power by public contest. The discourse is a research scheme to correspond with the documented stuff to get newest approach. In general, discourse analysis is a pattern of method to explore the construction of social realities. It is supposed that the understanding of policy making process by discourse analysis may update more about successful policy practices. The discourse study merely focused on social power with the dimension of sustainable energy policy and has become emergent subject of discourse analysis. The discourse research involves scan of communications and documents to gain new insights. Divine (2009) said that discourse is a analyzing of texts by a trace threads. As discourse analysis is widely used in qualitative research, reliable and valid analysis cannot be established as in quantitative research. The other short coming of discourse analysis is that it only

focused on language. Morgan (2010) discussed the one limitation of discourse analysis that in collection of options from different traditions may cause problems in epistemology, concepts and understanding for discourse analysis (Morgan, 2010). The applied methodology of any research has mainly focused on the research objectives and questions. The research question of this study is to analyze the Alternative and Renewable Energy Policy 2019, by using discourse analysis (Hajer, 2006) in rational approach concentrate on the identified research problem. Hajer's view about the quality of public policy in public domain was as explicit attention in a phase of joint deliberation. Thus policy discourse is constitutive of political community(Hajer & Wagenaar, 2003). Discourse analysis is an instrument of deliberative policy analysis. The rationale to apply the discourse for this research is to identify the gaps during the review of new inscribe Alternative and Renewable Energy Policy 2019 document. It will take part as an influential tool, a road map that may present diverse directions in upgrading of Alternative and Renewable Energy Policy 2019. Exploration of new trends in policy discourse revision will probably provoke an imperative approach to deal with renewable energy more practical.

- It is qualitative work with a process of examination to explore the social problems. This study examines the Alternative and Renewable Energy Policy 2019 document and based on the study also offer sound proposals and highlighted the shortcomings of Alternative and Renewable Energy Policy 2019.
- The discourse analysis has characteristic in identification of loopholes to make policy robust and comprehensive. Thus, we apply this method in our analysis to provide the influential role in the perfection of Alternative and Renewable Energy Policy 2019. Being a novelistic style in academia its contribution provides a roadmap and diverse direction for future analysis of Alternative and Renewable Energy Policy 2019.
- The discourse analysis is suitable for assessing the interviews, documented materials, conference speeches, research articles, media texts and policy drafts. We also analyze policy documents and for this type of data, this framework is most apposite.
- As a framework, it arranges basic and key factors to understand the phenomena of regularities of text and linguistics and its practices. This study may unearth the rational and logical frame and help towards in implementation stage.
- Discourse analysis may allow the change methods and our purpose of this study is to

highlight the unnoticed breaches in revision of the Alternative and Renewable Energy Policy 2019.

- Discourse analysis makes clear about ideas and themes of political efforts and also explores the social structures. Therefore, it is important to recognize how much has attainable from what is supposed in Alternative and Renewable Energy Policy 2019.

### 3.3 Hajer's Framework

We used Hajer framework in our discourse analysis to deal systematically with our identified research problem. Hajer (2006) is helpful technique. This method initiates with foundation of perceptive of an area to researcher to analyze the text as systematic tool. Initial step of this method is the organization of central theme of research area to endow with a set approach in analysis of a policy text and a document. The available literature is comprehensive and has ample use of Hajer (2006) as a tool in the analysis of policy. Isoaho (2019) in his study found that discursive methods used to evaluate institutional changes and energy choices in policy framework at the national level through political ideology and public perceptions (Isoaho & Karhunmaa, 2019). The applications of discursive methods have some substantial implications provision on energy policies like new knowledge and construction of certain realities. We find very less the use of Hajer's as method to analyze the energy and power policies as it is emerging trend to analyze the public policy using Hajer's framework which comprises of ten systematic steps.

i. **Desk Research;** First step of this technique, consist of a reading assignment of sequential list of events. To gain an extensive understanding of research area, there is a need to read diverse interrelated documents. At this stage, to make logical milieu of this research and to gain wider spectrum of knowledge, I read different documents like Policy of Renewable Development 2006, Midterm policy 2011, Alternative and Renewable Energy Policy 2019, National Power policies 1994-95, 1998, 2002, 2005, 2013, A report of IEEFA 2018 Pakistan's renewable energy, Pakistan energy vision 2035, A report of IREA 2018 on renewable energy policies in a transition time and other scholarly articles and papers.

ii. **Helicopter interviews;** To obtain the viewpoint of different players of this area like key government advisor, expert policy maker, technical and financial expert of renewables both from public and private sectors, and a well-resourced media person, we had conduct four helicopter interviews. By conduction of these interviews from

four helicopters, we gain the perspective of different stakeholders. We selected four helicopters as Hajer's demand of three to four interviews at this stage to have an input and overview about subject research. Selection criteria of below mentioned helicopter interviewer's based upon their expertise, research and technical knowledge in the field of energy and power policies in Pakistan.

**Table 4 Helicopter Interviewer's**

| No | Organization |
|---|---|
| 01 | US AID |
| 02 | Executive at NEPRA |
| 03 | Energy Policy Expert |
| 04 | CEO AEDB |

iii. **Document Analysis;** This stage is the identification of metaphors, narratives, descriptions, dissertation spots and sites of discursive struggle based on logical records. The discursive struggle is abstraction of article on logical evidence. The Alternative and Renewable Energy Policy 2019 document deliberately studied in detail along new supportive texts to consider the stance and forthcoming of players effective in the renewable energy cited in stage 1. Again continue the detail search of documents mentioned on stage1.

iv. **Interviews with key stakeholders;** This type of meeting will facilitate in assembly of contender discourses to sight the research problem with diverse optics. In this phase, we conducted in-depth interviews on identified areas policy, institutional and implementation frameworks with eminent and experts of renewable energy sector to take in research the objectives in detail and in more comprehensively.

v. **Argumentation Sites;** It is based on advice and recommends a researcher to get the outlook from mix spectrum. The podiums may include the parliamentary discussions, minutes of meeting, panel discussions on different forums and conferences, evidence base presentations and interpretations about policy draft and policy frame. Use of secondary data, we analyzed comments of different stakeholders on policy.

vi. **Analyses of position effects;** In this step, examine the stalled of interaction by the public and institutions. At this stage, we were able to categorize about the stance of

government and non-government institutions operational in the renewables sector by the interviews and profound analysis of policy documents.

vii. **Identify Key incidents;** In this stage, a researcher is being made possible to comprehend the robust modes of discourse dynamics as well as the effects. This step has include policy time, policy dynamics like when and where. We have discussed the policy timing and its status after the 18$^{th}$ amendment. We also discussed the dynamics of Alternative and Renewable Energy Policy 2019 i.e. when, where and right time of policy formulation.

viii. **Analysis of practices in particular argumentation cases;** At this stage, we have revisited the original data, discussion and document to identify and explore the say and practices of policy. We checked implementation mechanism of policy. Although the policy is nascent and yet to be implemented thus in our questioner, we try to get the perspective and expert opinion about implementation mechanism.

ix. **Interpretation;** In a perfect scenario, a researcher be supposed has description of logical discourse formation inside the frame of set argument. At last, this analysis has end on logical interpretations of arguments, interviews, and remarks, notes of key stakeholders and expert opinion of renewable energy sector.

x. **Second visit to key actors;** The last key step done before fusion of findings of research. From now, return to some key stakeholders to get behavioral change of respondents if any and able to get an answer of some additional questions for more explanation, if required is vital for the analysis. This step is excluded in this analysis because of current scenario of Covid-19.

### 3.4 Text mining

As the technologies become mature, the accessibility of digital data is in extensive use. Text mining is a process to extract useful, interesting and hidden information from large unstructured and ambiguous textual data. The aim of text mining process is to turn the input unstructured text into output structured data. The course of text mining includes retrieval and extraction of information, techniques of data mining, visualization and predictive analytics (Kumar & Bhatia, 2013). An innovative emergent area to include new research methods and software techniques like R, Python, and Orange are being in wide use in academia, government functions, and companies to tackle economics and finance. In every phase of policy-making process, there is always some formation of

verbal and written communication which has increasable presented in electronic form to analyze of large textual data through the tools of text mining. It is imperative to use text mining in this study to catch up the novel features of policy making process in Pakistan and it will introduce fine distinction to policy documents. There is no text analysis available in literature on alternative and renewable energy policies of SAARC countries. This research work study is an effort to fill this literature gap, as a comparison of alternative and renewable energy policies of SAARC countries on renewable energy sector.

### 3.4.1 Data and Methodology

In this phase of study, the following alternative and renewable energy policies of SAARC countries have been reviewed.

**Table 5 SRRAC Renewable Energy Policies**

| **Country** | **Policy** | **Year** |
|---|---|---|
| Afghanistan | Renewable Energy Policy | 2015 |
| Bangladesh | Renewable Energy Policy | 2008 |
| Bhutan | Alternative Renewable Energy Policy | 2013 |
| India | National Wind-Solar Hybrid Policy | 2018 |
| Maldives | Energy policy and strategy | 2016 |
| Nepal | Renewable Energy Subsidy Policy | 2016 |
| Pakistan | Alternative and Renewable Energy Policy | 2019 |
| Sri Lanka | National Energy Policy and Strategies | 2008 |

Text analytics is applicable by using analytical tools of automated algorithms to find out from set of textual data like official documents, annual reports, books, newspaper reports to compare and sum up main concepts and keywords. The use of automated algorithms is helpful in reading of substantial manuscript and to make synopsis of central themes of text. Text analytics is being used as a common approach for policy analysis internationally. Following are the steps that were performed for text analytics;

- Converted the scanned polices into text files and lower case.
- Analysis was made after corpus building of all policies.
- Removed all punctuations, stop words, numbers and extra white spaces.

- Stemming; removed the common ending words from English.

### 3.4.2 Word Cloud and Limitations

It is a tool of visualization to highlight the frequency of words in a text or in a document. One drawback using word cloud is that the word corpus never explains the context of the content for different words as they simply demonstrate the stagnant vision of the content. The issues of statics word cloud like empty spaces between words, co-occurrence, node overlapping, can be controlled by using mathematical functions like Wordle, grid-based algorithm and family algorithm. A technique named entropy estimation introduced by Kamel Aouiche to control the visibility and measure the disparity of different font styles and sizes in word cloud.

# Chapter 4: ANALYSIS AND DISCUSSION

## 4. Discourse Analysis and Text Mining

## 4.1 Alternative and Renewable Energy Policy of Pakistan: An Overview

To promote the clean, sustainable and affordable energy, new government of Pakistan Tehreek Insaaf in Pakistan has formulated new document of renewable energy policy commonly known as Alternative and Renewable Energy Policy 2019. To analyze the policy discourse, we apply the Marten Hajer's (2006) framework analysis of policy discourse. The Hajer's (2006) is a systematic model of ten steps; desk research, helicopter interviews, document analysis, interviews with key players, identification of key incidents, analysis of practices in particular cases of argumentation, and interpretation. This chapter is the application of the above steps to Alternative and Renewable Energy Policy 2019.

## 4.2 Desk Research

In this study this is the first step consist of reading assignment on said topic. It is vital in set up of a stiff concept of given study. In this phase of this study, the relevant material has been studied in this research. Firstly, the chronological background of renewable energy and its consequents in Pakistan is analyzed. All the prominent policy documents related to alternative and renewable energy have been consulted and reviewed like **Alternative and Renewable Energy Policy 2019**, **Policy for Development of Renewable Energy for Power Generation 2006**, **Midterm Policy 2011**, **Net metering policy 2015**, A report of IRENA named "**Pakistan's Power Future; Renewable Energy Provides a More Diverse, Secure and Cost-Effective Alternative, Renewable Readiness Assessment: Pakistan 2018**", and another report of IRENA named "**Renewable Energy Policies in a Time of Transition**".

The initial document on renewable is policy for development of renewable energy for power generation 2006 projected the different actions to tackle the energy crisis in the country. It is the first ever document on the adoption of renewable energy technologies in Pakistan. The policy consists of three stages; short, medium and long term. The short term span was ended in 2011 by the midterm policy. This document has some basic policy guidelines and direction for the power sector to shift the energy mix from the fossil fuels to the renewable technologies with full and active collaboration of private sector. The policy framework stimulated the adoption and promotion of micro-scale, deregulated and standalone integrated energy system. The document highlighted the

intended efforts to set up and designed the new projects of solar, wind, biomass and hydro to attain the energy security, economic benefits and environment safety by using the diverse energy mix. The policy goal of this document was to increase the renewable energy technologies with the introduction of investor friendly incentives to cater the renewable energy market. The road map of this policy mainly consist of the short term, medium term and long term developments. The policy deregulates the small scale power generation from renewables up to 5MW hydro and 1MW net meter scale for reduction of transaction cost. Although the policy recommendations are good enough as being considered the first policy document on the renewable energy but without seen the implementation mechanism of the given objectives as it is evident from the energy mix of the Pakistan the renewable share is 2% (Ministry of Finance, 2019). Moreover, this document has merely focused on the power generation and failed to put attention on the transport sector as the most active sector of renewable technologies. After the commencement of policy for development of renewable energy for power generation in 2006, the Pakistan is still distant from the completing the green path of sustainable energy development.

The second document in this phase is midterm policy 2011, which was initiated as extension of the short term renewable policy 2006. This policy addressed the existing conflicts and the unease of the key stakeholders. The policy noted in the concept formation regarding renewables as better rate of return. The mid-term policy provides the basis in the development of non-electric renewable energy and bio-fuels policies. The policy is being considered as an implementation mechanism of the financial recommendations of the Policy for Development of Renewable Energy for Power Generation 2006, in terms of incentives expansion for alternate and renewable energy projects in the country like Alternate energy development fund, Asian development bank credit assurance facility, fractional resource risk coverage, credit market facility, 100% carbon credit to independent power producers, mandatory grid connection.

An important document in this discourse is a report of IRENA named “Pakistan’s Power Future; Renewable Energy Provides a More Diverse, Secure and Cost-Effective Alternative, Renewable Readiness Assessment: Pakistan 2018”. This report is a detailed assessment on renewable resource utilization in Pakistan. The report suggested reform agenda and measures on policy interventions mainly on regulatory transformations, investment incentives, and infrastructural developments for steadily renewable energy growth in Pakistan. This assessment report is a consultative process with the government has done holistic examination of energy sector. The report identified the key policy actions to accelerate the renewable deployment in Pakistan. The report also provides a setting of

multi-stakeholder discourse and help in identification of renewable deployment challenges. The report presents short, medium and long term policy way forwards to reinforce and reform the right policy frameworks of regulations, implementation and institutional to open up the capitalize and potential environment for renewable energy in Pakistan.

**Alternative Renewable Energy Policy 2019**

The recommendations of above mentioned IRENA's opened a way to formulate new Alternative and Renewable Energy Policy 2019 as it is the most recent policy attempt to attain targets of energy security, affordable electricity, environmental protection, sustainable development, social equity, and climate change mitigation in Pakistan. The policy emerged with multi measures. The policy proposed many interventions like net metering, competitive bidding and auctions but without clear implementation mechanism. Lack of institutional capacity, financial restrictions, low in technology and untrained human resource have been identified in all major studies however, some studies highlighted the conflict in policy framework merely focused on policy instruments like regulations and financial and also recognized the poor implementation framework.

In addition, as a part of desk research the study examined the academic piece of Mirjat (2017), which analyzed the country's energy and power policies in an inclusive style. The paper is very substantial and besides policies history, he added different globally applicable energy models in detail. Mirjat et al. (2017) has understanding that to support the policy framework there should be supplement of integrated energy model. Study convinced that in absence of energy model, the effective policy formulation and implementation mechanism of any energy policy is ambiguous. The methodology articulated diverse energy model tools e.g. MARKAL/TIMES; LEAP, ENPEP BALANCE, MESSAGE and ENERGY PLAN in the study. This study is pragmatic in devising the rational energy policy incremented by integrated energy plan for sustainable energy system. Thus the analysis of Mirjat et al. (2017) is a valuable milestone in carrying a detail discourse.

In a same way another academic work of Zafar (2018) gave an introductory review of renewable energy policies of 2006 and 2011. As this was first and only analysis of RE policy in available literature on renewable energy policy in Pakistan. The work of (Zafar et al., 2018) was appreciated as a cross country analysis yet this was not in detail and not well organized. Although (Zafar et al., 2018) claimed a critical review but he did not use a proper methodological framework. It was more a SWOT analysis with shallow approach rather than a critical analysis.(Zafar et al., 2018) work was not catalyst clue in analytic frame and not suggested any way forward for future energy policies.

By revision of all documents of renewable energy, we recognized that Pakistan has geared up its efforts for deployment of renewable energy technologies. Pakistan shows it's dedication in framing policy and legislative measures for the promotion of clean, secure and affordable energy for sustainable development and economic growth with the cooperation of international energy and funding agencies. Formation of Alternative and Renewable Energy Policy 2019 with the target of 25% and 30% share of renewable in national energy mix by 2025 and 2030 is a sign of Pakistan's promise and will of adopting IRENA's three fold strategy of energy, economics and environment.

At this stage, some additional academic articles were also considered in a same way. After a deliberated study of all policy documents and related stuff, we have gain an explicit knowledge that renewables are important for Pakistan to achieve the energy, economic and environmental targets. Thus, by meaningful information and interest about renewable energy diversification, we brought to close our first step of discourse analysis.

### 4.3 Helicopter interviews

This is the second step in our analysis. The rationale of helicopter interviews is to search out a general impression of Alternative and Renewable Energy Policy 2019 from multi perspective opinions. As per Hajer, 2006 framework, the four actors has identified for conduction of helicopter interviews from different backgrounds with diverse experiences like a key informed journalist of renewable energy, a key government official, a policy expert of renewable energy and a technical expert of renewable energy technologies. We conducted the helicopter interviews with the above mentioned experts who have in depth knowledge of renewable energy policies and technologies in Pakistan. The names of these four helicopters are kept secret however; their positions and departments have mentioned above in table 5 below. The questions asked from these helicopters are attached in Annex A.

#### 4.3.1 First Respondent

Our first helicopter interviewee was a member of energy board at US-aid Pakistan and a former project manager of renewable energy projects in State Bank of Pakistan. This respondent has a vast experience and sound knowledge on the financial costs of renewable energy projects. The respondent recognized that it is necessary to conduct a thorough analysis of this policy document by academics since there is a lack of academic research on analysis because of the fact that policy is nascent among academic circles. Failing to do so may result in billions of rupees in losses if it

doesn't consider grid stability, power demand and transmission capacity. Moreover, the previous policy must also be evaluated on an urgent basis to add improvements in new policy. On the question of policy timing and measures he responded that the policy could have come earlier. Because the earlier policy was made in 2006, renewable energy dynamics were entirely then compared to the previous five years. Failing to make a new alternative and renewable energy policy in the past five years has resulted in higher tariffs compared to global renewable energy tariffs, thus a loss for the government and consumer. The proposed measures seem appropriate and sufficient but lack an implementation plan; it means that policy is silent on the role of implementers. When asked about the policy targets of 20% of total grid capacity to be renewable energy based by 2025 and 30% by 2030. This target seems un-pragmatic given transmission bottlenecks. Because renewable energy is intermittent, it can destabilize grid functionality, unlike thermal base load power plants. All the other characteristics seem realistic in terms of standards and achievability.

The IRENA emphasized on the three fold strategy in the promotion of renewable energy sources energy, economy and environment it was asked in case of Pakistan these are equally important or one of them is most important? To him in the case of Pakistan all are important but not equally. Energy stability and affordability would be of prime importance, followed by its capacity to boost economic growth. Environmental factors are important but not as much as energy continuity and affordability as Pakistan faces poverty in its extreme form, which clearly dominated environment.

In response of best policy options to promote consumption of renewables in Pakistan the respondent argued that Off-grid solar and net metering are our best options and the government should encourage financial institutions such as banks to promote financing for the large-scale use of this in residential homes all across Pakistan. That would save billions of rupees in grid investment as well as expensive fuel costs. On the role and importance of institutional capacity to implement the policy the respondent agreed that institutions have to play instrumental and effective role in policy implementation but unfortunately in Pakistan the institutions remain weak and underfunded. Moreover, human skill lacks in policy circles in the government. Furthermore the respondent added that policy lacks implementation mechanism so it does not seem attainable due to institutional constraints, weak HR skill and governance. Moreover, indexing Dollar returns to renewable energy investments is again a mistake which needs to be reviewed which is being considered as another hurdle.

Will the 18th constitutional amendment impact on policy? The respondent expressed, Yes it would. The amendment allows provinces to set up their own projects and transmission infrastructure. This

can cause confusion for investors and discordance between federal and provincial regulatory bodies.

In response of process of consultation with different stakeholders in policy formulation the respondent described in detail as according to press reports more than 130 senior government representatives and renewable energy professionals were actively involved in renewable energy sector participated in the Provincial Renewable Energy Workshops organized by the World Wind Energy Association with support from GIZ and the Alternatives Energy Development Board of Pakistan (AEDB). The workshops were held from the 5th till the 18th of July in Karachi, Lahore, Peshawar and Quetta gathered a select group of provincial renewable energy heads and senior government leaders to discuss and debate on the draft Alternative and Renewable Energy Policy 2019 (ARE Policy 2019). The aim of these gatherings was to garner support and initiate a discussion on the renewable energy market in Pakistan in line with the government's plan to supplement 30% of Pakistan's power needs through renewables by 2030, in addition to 30% of hydropower. Thus in respondent's view, solid and comprehensive draft has obtained after consultation with all the relevant stakeholders.

On the question of the difference between pervious and present renewable policy the respondent said it will face the same fate as the previous policies. But bear in mind, the previous policies were not complete failures. The 2006 renewable energy policy did bring in sufficient investment in wind power in Pakistan. Therefore, if this policy even achieves 50 percent of its goals, I would consider it as successful.

The respondent remarked that policy is in nascent stage and it must be reviewed, analyzed and evaluated as a robust and effectual contribution before set up of action plan which may have provide a base to policy measures.

### 4.3.2 Second Respondent

The second Key Informant was senior executive at NEPRA Islamabad was our second helicopter interviewee. He gave us the government perspective about AREP. The respondent has the stance regarding analysis and evaluation can craft this policy a new excel. The respondent holistically supported this analysis of Alternative and Renewable Energy Policy 2019. On the timing of the policy, the respondent argued that policy should come earlier because Pakistan has grim economic situation due to decelerating foreign reservoirs on the cost of fossil fuels. Furthermore, the respondent added that in the SAARC region Pakistan is far behind in the consumption of its renewable resources in power production. Adding about proposed policy measures, the respondent

argued that these measures are partial sufficient because at present scenario renewable technologies are changing worldwide and some measures are not established realistic with no proper data and background.

When asked about the IRENA's threefold strategy which one is important for Pakistan energy, economy and environment, the respondent expressed that Pakistan has energy deficit status nation so we have to balance the economy and energy, nevertheless environment has its own core concern for Pakistan because vulnerability index shows Pakistan's number 5$^{th}$ position. So there is need of effective handling three areas.

The respondent supported the development of small scale off-grid solar and wind installations by increasing subsidies and incentives for each level of installation as best options in consumption of renewables in Pakistan. On the question of hurdle the respondent said that it is not matters of interest how much strong feasibility report of any renewable project until a robust policy support the developments of such projects, and this policy is ambiguous about the mechanism of renewable projects.

On the importance of institutional role in implementation system the respondent expressed with the concern that policy is unclear and lacks in framing the institutional capacity in the establishment of renewable energy technologies in country. The respondent said as discussed earlier that policy has unrealistic measures which may have hurdle in the implementation stage. Without the technical expertise and skillful and trained human resource, institutions cannot work.

To answer the question on clear and attainable implementation mechanism the respondent explained that the time frame and action plans are important aspect of implementation mechanism which is not the part of this policy.

On the response of 18$^{th}$ amendment the respondent expressed that after the devolution plan under 18$^{th}$ amendment, the policy will face serious impacts due to financial and human specialty constraints. As the policy allows the federal government of automatic dedications of outstanding power dues owned by the provinces from NFC award and this mechanism will create mistrust and more ill among federating units. The respondent further added that all the provinces especially Sindh has raised grim objections on the role of steering committee headed by the joint secretary of federal ministry of energy and AEDB as trespass on provincial rights and financial powers enshrined under 18$^{th}$ amendment.

On the consultation process of policy formulation with all relevant stakeholders, the respondent take was quite surprising as the respondent said that policy formulation is a gigantic assignment and it

should required serious and deliberated consultations with all relevant quarters but unfortunately NEPRA was not on board in the formulation process of policy.

On the question of comparison between past and this policy, the respondent said that in renewable energy policy 2006 there were feed-in tariffs but in present policy the main determinant is that the on the basis of open bidding process using lowest evaluated tariff will determine. Further the respondent added that there shall be an exclusion of corporate income tax and waiver off custom duty on the imported equipments and machinery for all renewable energy projects under this policy.

### 4.3.3 Third Respondent

Our third helicopter interviewee was conducted from a sustainable energy system, planning and development expert have specialty of energy policy formulation and evaluation. Currently the respondent is freelance in Daily Times. Respondent's critical aspect has valuable input in this analysis. The respondent emphasized that critical analysis and evaluation of policy as a comparison with the pervious renewable policies must be vital among academic circles. The respondent said the approved draft is tall in intent but the content is vague, abstract and lacks the essence that may consider as nucleus to attract the ailing power sector. On the time specification of policy, the respondent described the policy is a classic example of moving backward because policy is not a need of day. The respondent added that the policy is not identifying the metrics that leads to the failure and success of renewable energy projects.

When asked about the policy measures are realistic having some background, sufficient and appropriate considering Pakistan's energy deficit status, the respondent argued critically that all are sound high and cherished, however lacks the specificity, compactness and related timeframe to direct the power sector entities. The respondent said that the proposed measure in present form of policy may not support the government to achieve the strategic objectives for economic revival, clean and energy security.

On IRENA three-fold energy strategy, the respondent indicated that policy focused on affordable energy security which is correlated with economy and environment thus in case of Pakistan the equation of sustainable energy, economic boost and environment is very critical. The IRENA has given great importance on the development of local industry and employment to eradicate the foreign dependence on alternate and renewable energy technologies. Being an active member of IRENA Pakistan should consider this aspect of energy, economy and employment in this policy because no such themes have given in the present policy.

For the promotion of renewables in Pakistan the respondent said for the success for policy and renewable sector, the storage technologies like utility scales and behind-the-consumers meters can be effective in this regard. The respondent highlighted that uncertainty and variability are the two inherent characteristics of renewable energy technologies and there will be need of extra efforts to offset these which will increase the grid cost. The policy lacks incentives or concessions in this aspect.

The respondent further added that policy is not ideal and as a new policy, it may have certain loopholes which will lead to hurdles. The policy is not specifying the share of different renewable energy projects and technologies within the particular targets and regions. This lack of transparency will lead the hurdles during the implementation.

On the role of institutions on policy implementation the respondent critically argued that the policy leaves the desire institutional capacity which is being measured as a key in accomplishment of strategic goals mentioned in policy. The respondent said that government should place the crucial leadership and management capacity, technical skill and supportive tools on ground to make the success role of policy. The respondent said that due to ineffective institutions and unclear implementation mechanism, it is quite obvious that policy will have unattainable implementation challenges.

The impact of 18$^{th}$ amendment on policy, the respondent objected the provinces right to develop autonomous renewable power generation projects in their control, free of national grid. The respondent argued that it is not an excellent proposal and to avoid future uncertainties and sub-optimal solutions all the alternate and renewables projects should be centrally coordinated between federal and provincial governments before bid solicitations from potential investors and developers.

Arguing on the consultation process of policy formulation the respondent criticized the consultation process and said that energy policy is a key tool used by the governments to direct and persuade the behaviors of different stakeholders of related to power and energy sector to attain the desired objects and goals. The government should always use incremental approach in the introduction of reforms and modifications in the previous policies to protect the trust and interests of relevant stakeholders.

On the past policies experience the respondent said that, approximately 2000 MW of renewable generation was added in the national grid as a policy initiative of renewable energy 2006. The pervious document appears much better than the new one. The respondent criticized and said the decision unwise and hasty to get rid of the investors working under renewable energy policy 2006

on 8000MW renewable projects. The respondent pointed that 140 renewable projects were commenced by the provinces under renewable energy policy 2006 and these should integrated in the new policy to grip the existing investors. The respondent insisted that policy should be review before come into action.

### 4.3.4 Fourth Respondent

Last interview was conducted from a high ranking official in AEDB was our last helicopter interviewee. The respondent's office has the mandate to draft the Alternative and Renewable Energy Policy 2019 under his kind supervision. Like previous interviewees, the respondent also put emphasis on the evaluation and analysis of the new policy by academic circles. The respondent expressed optimistically that this analysis will be helpful in solid and valuable discourse.

On the timing of policy emergence the respondent said that the current trends in the renewable energy technologies and worldwide energy markets dynamics compelled the new government to establish of new policy and it shall very encouraging initiative to overcome energy loses in the country. The respondent said that policy developed on the need of at hand circumstances where the emergent technologies have developed very speedily and as result the cost of power generation is going down day by day.

Responding on appropriate and sufficient policy measures the respondent said in present scenario the given measures are perfect and absolute and also they can be reformed with the time passage as the innovation will develop in the renewable technologies. The respondent further added the policy measures are on realistic grounds and will addressed the energy crisis in the country but there is enough room available to assess them on empirical basis.

The respondent said that as per IRENA policy energy, economics and environment have equal importance for Pakistan. The respondent said that aspire of this policy is to start a conduction scene for clean and sustainable energy growth in accordance with the UN sustainable development goal 7A. This will unlock an innovative domestic industry of renewable energy market and will lower the average basket cost of power generation. The promotion and adoption of renewable energy will help out in displacing the country's energy basket from expensive imported fossil fuels. The additional benefit of renewable energy deployment resides in reduction of green house gases emission and protection of environment from the current thermal generation. He added that carbon foot prints cannot be overlooked when Pakistan is at $5^{th}$ position of environmental challenges.

On policy options the respondent said that policy focused on installation of decentralized

renewables sources based on public private partnership for domestic and industrial sectors to develop their own energy system. For this purpose there should a provision for public sector that a part of open cost of development of decentralized renewable source of energy through loan concession in addition giving assurance for purchase of excess energy by national grid.

The respondent holistically expressed that no hurdle is in his judgment but possibly implementation is a key pace but with the support and commitment of ministry of energy and power AEDB will be able to implement the targets successfully.

Responding on institutional capacity in the implementation of targets the respondent viewed that the present government of Pakistan Tehreek Insaaf under its reform agenda put great emphasized on the restructuring and capacity building of the institutions. The respondent showed strong commitment about the effective and capable institutions to attain the policy objectives. The respondent said that there is a network of institutions and attached departments under the control of federal and provincial ministry of power and energy. The policy demands firm commitment for establishing of workable institutions with the objective to train the human resource for renewable energy market because he viewed that institutional capacity has connected with the implementation mechanism.

Regarding the clear and attainable implementation mechanism the respondent said that policy is just a guide line not an action plan and implementing mechanism of policy measures would be the part of that action plans.

The respondent countered the impacts of $18^{th}$ amendment on policy by giving the importance of central steering committee. The respondent said that this committee consists of members of ministry of energy and power from all provinces under the federal joint secretary and will work as a driving force. The respondent further highlighted the importance on this steering committee that all the provinces have immense part in decision making of feasibility and planning of renewable projects and technologies.

On consultation process the respondent was very satisfied and said that all the major and relevant stakeholders from public, private and donor agencies were consulted in the policy formulation. The private sector and entities included in the consultation were world wind energy association, renewable and alternate energy association of Pakistan, Pakistan wind energy association, Pakistan solar association, solar quality association, Pakistan sugar mills association, Energy update group, leading law and consulting firms. The multitier donor agencies including World Bank, ADB, IFC, USAID, UNIDO, KFW were part of consultation.

The respondent said that policy is new and it possibly will have certain loopholes and shortcomings

and that it would be always welcoming from our side to reconcile the unnoticed areas and unseen measures. The respondent reflects fate of policy as booming and clears with the commitment of ministry of energy and power as well as with the support of private investors and donor agencies.

### 4.3.5 Synthesis of Helicopter interviews

All helicopter respondents have the consensus on some common points that policy needs a comprehensive analysis to address the certain loopholes and shortcomings, policy measures are sufficient and on real grounds but policy targets seemed to be unrealistic. On policy options our respondents identified the decentralized, off grid solar, wind and net metering solutions. On policy framework, respondents perspective was that to introduce of policy intervention like financial and fiscal incentives will helpful to attract the private sector for the development of different renewable energy projects. Respondents have common views that Pakistan's Alternative and Renewable Energy Policy 2019 should align with the IRENA's three-fold strategy on energy, economy and environment. On implementation and institutional frameworks, respondents rightly highlighted key bottlenecks in the policy like institutional red-tapism, complex regulatory framework, poor energy management, low awareness among masses about energy conservation, unskilled labor, poor infrastructure of transmission and distribution and lack in technical expertise.

## 4.4 Document Analysis

At this stage we studied the draft of Alternative and Renewable Energy Policy 2019 in detail, keeping the above cited viewpoints of different helicopter interviews. We also dug up the report of IRENA "Pakistan's Power Future; Renewable Energy Provides a More Diverse, Secure and Cost-Effective Alternative, Renewable Readiness Assessment: Pakistan 2018", another document named as "Renewable Energy Policies in a Time of Transition" as these documents have done in detail in step 1 of our discourse.

The Alternative and Renewable Energy Policy 2019 presents a comprehensive framework to adopt the strategic objectives of clean, green and affordable energy for all, energy security, and significant economic growth through sustainable development, social equity and environmental protection through lessening of climate change. The document focused on the adoption and promotion of policy measures for deployment and development of all alternative and renewable technologies and sources primarily solar, wind, biogas, small hydro, geothermal and solid waste. The policy highlighted the importance of institutional role and acknowledged improvement of institutions role

and capacity in terms of skills and training to human resources to the renewable resources and technologies collaborated with international donors.

After reading the policy document in detail with different perspective, we scrutinized that a comprehensive **policy framework** enfold with diverse themes like **policy options, policy interventions, policy instruments, and policy tools** to achieve the strategic policy objectives. It is important to understand that the spirit of this policy framework is very close to the IRENA's three fold strategy energy, economy and environment.

After interviews got done with the aforesaid renewable energy experts and in detail analysis of Alternative and Renewable Energy Policy 2019 document by getting the views from public sector officials, media reports NGO's working on energy sector and after in-depth reading of different aforesaid documents, we come across following core themes of policy in our discourse. These include **policy framework, institutional framework and implementation framework** and identified as the main piece of our study.

### 4.5 Interviews with Key Players

To understand the alternate vision of prism, these in-depth interviews are very important in this aspect and to enable the researcher to get other view of discussion. These interviews are different from the above conducted helicopter interviews as these covered the aforesaid extracted themes from the policy document that are policy framework, institutional framework and implementation framework. To get in-depth analysis of extracted themes, special and separate questions are designed for each of theme and inquired from each interviewee. The questions are attached as Annexure B. We carried out these interviews from the policy experts and makers, academia and individual's working in the energy sector especially alternate and renewable energy sector. The list of interviewee are enlisted in Table 6

**Table 6; List of interview**

| Serial No | Affiliation |
|---|---|
| 1 | Top Ranking Official, AEDB |
| 2 | Senior Executive, NEPRA |
| 3 | Financial Advisor, USAID |
| 4 | Joint Secretary Ministry of Energy KPK |
| 5 | DG PCRET |
| 6 | Energy policy expert, Daily Times |
| 7 | NUST |
| 8 | Director REAP |
| 9 | SDPI |

### 4.6 Sites of Argumentation

In this step, we get the viewpoint that found from two organizations AEDB, SDPI, and from IRENA's report named "Pakistan's Power Future; Renewable Energy Provides a More Diverse, Secure and Cost-Effective Alternative, Renewable Readiness Assessment: Pakistan 2018".

We explored the insight of AEDB which has the mandate of Alternative and Renewable Energy Policy formulation and renewables deployment and promotion directives. The respondent from AEDB claimed that a comprehensive consultation process was made with all relevant stakeholders and attached departments before formulation of final draft. Policy formulation is a gigantic and deliberated event and it should be done with great care. Policy is not static in nature and it steps forward with incremental and evolutionary approach. In a policy, there is always enough space of revision, alteration, and modification after evaluation and analysis. Similarly, this policy has itself need of more research and analysis. The respondent from the AEDB holistically expressed that robust and balanced suggestions based on rational findings will always be welcome in future. The respondent assumed technical and lack of skill human resource is a major hurdle which will be gear up with the international collaborations. On the financial concerns the respondent believed that NFC award is a right forum to address financial constraints on renewable energy projects in provinces. The interviewee affirmed that to an impartial and cogent institutional arrangement is demand of today that will have the competence to deal with the impending issues of policy implementation. To explain the implementation mechanism, a policy always has some action plans based on policy measures which will be initiated as a precondition of policy implementation stage.

Key informant from SDPI acknowledged the importance of Alternative and Renewable Energy Policy 2019 along with some unease. The respondent identified that policy unnoticed the marketability of renewable energy sources in Pakistan. The respondent insisted a financial analysis of policy to look the set-up cost of business required for renewable projects in country because installation process of renewable energy systems is costly in Pakistan. The respondent said that SDPI works on program of sustainable development which has cogitation with green energy and clean environment. The respondent expressed deliberately that our team is trying to provide government productive policy interventions for investments and deployments of renewable energy to expand the market under clean fuel program.

IRENA's report is important policy guideline in provision of technical assistance and best power options based on available renewable resources. This assessment report has significance worth in shaping of policy making, investment openings and energy related actions because there are basic

policy inaccuracies related to renewable energy development as a key barrier of sustainable development. The report describes the how to devise the effective implementation mechanism for renewables to attain the strategic targets and improve the energy security in Pakistan. The report also highlighted the key policy tools like competitive bidding for innovative renewable projects, net metering for distribution of power generation, infrastructural developments to increase institutional capability. This report comprehensively highlighted the existing grid infrastructure constraints and technical challenges, suggested best option to reduce the costs to strengthen the renewable targets by inviting the private investors for off-grid and rural electrification.

Furthermore, the report highlighted that there is no solid institutional mechanism has adopted or formulated by federal and provincial agencies for effective implementation of policy targets especially rural electrification issues and considered it as policy constraint. Besides this, economic and technical hurdles are lingering and crucial lacking in technical expertise impeding the growth of renewable market in country.

## 4.7 Analysis for Positioning Effects

We viewed the standpoint of policy experts working in different organizations, academia and NGO's person and journalist by conducting in-depth comprehensive interviews along with structured questions comprised of our core three themes attached with Annexure B.

Public policy is an instrument used by the governments to take on board, guide, organize, and influence all the major stakeholders to attain the pet targets partially or completely for public socio-economic development by defined objectives. A policy set off with a baseline has some strategic plan traces a course towards to achieve desired solution.

### 4.7.1 Renewable Energy Policy Framework

An inclusive policy framework is our first area of analysis. It is evident that world is blessed with renewable resources thus a significant global trend of renewable energy policy framework have increasingly developed. Worldwide policy makers have concentrated more focus primarily on power generation from using renewable energy. The alternate and renewable is a sub-sector of national energy policy and it should have a clear scheme and strategy. Informant from AEDB supported the view that alternate and renewable energy projects should be backed with political announcement and vision statement. The next stage of alternate and renewable energy projects should have energy strategies and scenarios based on national energy data and this will lead a

comprehensive roadmap and action plan. A legally bind alternate and renewable energy projects have targets, laws, obligations and standards. Another key informant said that policy objectives and policy constraints are the key drivers of renewable energy policy landscape. The respondent supported his arguments by saying that a predictable policy support is imperative to take full range advantage of renewable energy technologies in country. Another resource person had also similar views and he said that alternate and renewable energy projects framework must be based on evident matured technological and institutional settings which are the key to success of policy. Progressive policy making will show remarkable and successful impacts on renewable energy future in Pakistan. Alternate and renewable energy projects has diversified and rich landscape devised by different countries with different set of frameworks. Global renewable technologies have gain matured status in world energy markets thus the global renewable policies have adopted the regulatory, fiscal and financial policy instruments for promotion of renewable energy in their economics. All other respondents are agreed that to evade the provincial approach consequences it is important to design careful and effortful policy framework and instruments in promotion of renewable technologies which gear up the economic policies of country.

#### 4.7.1.1 Policy Instruments

Globally different policy instruments in terms of financial and regulations are being used in parallel to extend the renewable power generation and electricity deployments through technological maturity. Instruments and tools are used to split the investment barriers and to increase the capital for renewables deployment. These include administratively-set fed-in-tariff, premium, auctions, electric utility quotas and obligations, renewable portfolio standards, tax rebates, carbon credits, capital grants, and net metering. The policy instruments merely depend on the energy market, technological advancements and policy objectives.

A key informant said that policy and regulation are the key drivers for investments for deployment renewable business and he believes that with the support and entail of specific policy measures, the policy targets have the tendency to turn into renewable investments and deployments. Investments are mostly driven by regulatory and fiscal support. Resource person claimed that the investment decision has dependence on renewable resources; ease of finance, country's risk in case of international investment and other such variables, therefore the need of alternate and renewable energy projects is to standardize economy with sustainable development approach by attracting new investors and to make new competitive market of alternate and renewable energy technologies.

Nevertheless, traditional and new fiscal and regulatory mechanisms may enhance the deployment of renewable technologies. `

#### 4.7.1.2 Financial and Fiscal

Fiscal incentives such as tax credits and rebates have key importance to overcome the financial constraints to renewable energy deployments and development. Fiscal and regulatory tools are being adopted to promote the mature technologies from large-scale business installations to small-scale domestic renewable energy systems. Financial support for initial deployment of renewables is important in absence of local supply chains and regulatory framework. To complete the policy targets there is always some financial and fiscal incentives in terms of policy support with the aim to attract the private investment. There is a need of rapid change in dynamic renewable market by increase in impressive investments set on the innovative business models to enhance the installation capacity in country. Government shows pledge in the policy document for the financial and fiscal incentives under law of Pakistan. There should provide a level playing field for renewable energy system and deployments in country.

Climate mitigation is a key policy driver and rational that cited in policy. An extent growth of renewable energy has directly linked with decarburization. The carbon pricing initiatives includes carbon taxes and trading system. Carbon taxes and emission trading mechanism is well recognized policy incentive worldwide to persuade interest in low carbon. AEDB has given the mandate to promote, facilitate and support the alternate and renewable energy developers to apply the most successful approach in acquiring carbon credits by carbon crediting mechanism under compliance market aligning United Nations Framework Convention under Climate Change (UNFCCC). AEDB has done efforts to expand its mandate to aid in local capacity development and understanding about carbon credit mechanism under UNFCCC and also provide facility of carbon credit trading in international market to support national designated authority in creation of national carbon credit trading scheme.

A well designed carbon pricing mechanism may drive the alternate and renewable energy technologies operation by internalizing various externalities of fossil fuels, in the way to increase the relative coast of fossil fuels. The impact of carbon pricing varies by renewable technology and energy sector along with power market prices within trading systems and government regulations. The carbon pricing and carbon tax should be implemented to replicate the true cost of fossil fuel, increase in carbon emission, air pollution and impacts on health quality.

Carbon dividend or carbon fee is a key of consistent transition from electricity to energy as it is a tool to balance the financial impacts of fossils consumption expenses. To make gradual increase on the taxes on fossil fuels consumption and as a result the revenue redistributed to taxpayers by dividends, rebates, tax reductions and fixed payments. This policy tool can shift the investment trend from traditional fossils to innovative renewable energy solutions.

In Pakistan the subsidies mechanism on fossil fuels has distorted the energy market because of lack in transparency. To remove fossil fuel subsidy there should introduce carbon pricing as a policy intervention and it needs political will and governance because greater political aspiration is must to accelerate the energy shift. The government should allow this subsidy to twist the renewable market from the electricity to energy. A political will is a major policy support and instrument to achieve policy targets and to accelerate the momentum in energy transition.

#### 4.7.1.3 Regulations

Energy sector regulators have empowered by legislative measures to form the market restructuring as to increase the renewable energy power generation by producers. NEPRA has established by NEPRA act in 1997 which evidently describes the structure, role and responsibilities under full regulatory command by the government. Tariffs for all modes of procurement of alternate and renewable energy projects will be denominated in Pak Rupee. The policy allows to AEDB and provincial energy departments to conduct public utilities competitive bidding procurements for solar and wind projects and discontinues both upfront and cost plus tariffs for established renewable technologies. NEPRA determine the tariff by considering the multiple features such as, resource availability, capacity factor, equipment and financing cost, operation and management expenses, project construction period and length of energy purchase agreement. Policy identifies the impact of competitive bidding in lowering the tariffs. Policy suggests simplification of regulations to remove the overlapping of regulatory subjects. To reduce timeframe, compliance cost and regulatory fee, the licensing framework should be ration and simple. For federally owned public utilities procurement is based on three modes, competitive bidding, government to government and unsolicited projects. NEPRA licensing rules were written for large utilities and power generation distribution. It is need of time to design fresh and unified licensing rules of self-generation and distribution for decentralized local energy systems, mini and off grid solutions. Policy advocates that NEPRA should remove entry barriers for non-utility procurements consists of prolonged and expensive steps like public hearings, technical descriptions of plant designs. To save commercial

interests in B2B mode of transactions, NEPRA shows its commitment by revisiting of license, fee and tariff regimes and make simple, low cost and time regulations for local energy systems to make viable market for mini and off-grid power generation and distribution.

#### 4.7.1.4 Auctions and Feed-in-Tariff

The policy suggested that the competitive procurement bidding of new renewable projects will be made by auctions on year basis. Auction is centralized and competitive procurement of renewables through government to government has emerged as policy instrument in driven of renewable prices especially solar PV and wind. Auctions may also be considered to overcome unplanned outcomes that were ignored in pervious power policies like segregation of local participants and specific areas project concentration. Auction base on legal frame, can guarantee on transparency and commitment. Auction mechanism should be flexible to design tenders and to meet national renewable targets and multiple policy objectives further than giving agreements at low prices. Globally 77 countries have held renewable power auctions.

Feed in tariff is also a viable policy tool to support utility scale renewable projects and provide stable income to generators. Feed in tariff may also used in technology have high project development cost. Auctions are being used for large scale projects and feed in tariff for small scale projects.

#### 4.7.1.5 Net metering

Small scale renewable energy projects need policy support for grid access and remuneration for surplus electricity to feed in grid. It is primary mechanism case that has a special regulatory framework for renewables power generation. The net metering regulations make possible of 33MW capacity so far. NEPRA issued several licenses for solar PV installations. NEPRA decide several key factors while designing net metering regulations like eligibility criteria, value of excess electricity, grid codes, taxes, entitlement period and geographical reparations. One of our respondent said that NEPRA should initiate of considerable attempts for credit facilitation and business awareness. Besides this, there should also tax and import duty exemption on net-metering equipment. AEDB has practical part in net-metering, by approved installer certifications and rating services. The respondent from AEDB claimed that in coming time AEDB will enable the on-line net metering submission procedure; integrate NEPRA, and clearness of DISCOs. In near future the increase deployment of grid connected net metering will lead to legal and political challenges and as a result will demand policy shift or revision.

#### 4.7.1.6 Policy options

New technologies and business models foster the renewables expanded energy access by the development of off-gird and stand alone renewable energy markets. Policy recognizes the incredible options of min-grids, off-grids, stand alone, decentralized energy system and business to business to attain the renewables deployment in country. Off-grid solution in the form of solar power has the most accepted and welcoming self-generation option. Mini grids and local energy systems has a feature of independent operation as to relieve the utility loads and being adopted to cater a cluster of consumers. Pervious national power policies focused on IPPs procurements for national power generation accumulation. Alternate and Renewable Energy Policy 2019 specifies the measures of regulatory support and leaves the solutions of reorientation from bulk power operation to the mini grids and decentralized local energy system to market operators and entrepreneurs. For this purpose attractive loan is viable option. Governments may also act as financial intermediaries to help small enterprises in this sector. Micro financing is another possible option to access energy markets for consumers to purchase clean energy markets. The issues related to safety and security of mini-grids and local energy systems may deal by AEDB safety certifications.

The respondent from AEDB said that decentralized energy solutions have the potential to attain the target of SDG 7 of universal access to energy along with other social goals like education, health, water, and gender equality and employment.

Policy has oversighted the incentives for captive power, a self-generation mode by industrial facilities. Globally captive power has gained the rise in trend to initiate the alternate and renewable energy technologies for large industries, business and offices. In Pakistan it is unaddressed and unregulated renewable option for bulk power consumers owned by federal procurement utilities.

Responding on the available best policy options that we have to attain in the country for affordable economically and environmentally the respondent said that renewable energy project cost has decline but still higher than thermal. The respondent from NEPRA suggested that to decrease the cost NEPRA should set up benchmark tariff for solar and wind projects based on competitive bidding. The respondent further said that competitive procure mechanism like auction may acquire renewable energy at lowest cost depends on the investors interest. To attract and influence on the decisions of private sector investment, policy consistency and inevitability are significant actions. AEDB should invest in the research and development to advancements in the battery storage technologies.

#### 4.7.1.7 Policy parameters

Policy covers both off-grid and on-grid renewable energy projects including net-metering. The on-grid included mini-grids covers all DISCOs/NTDC, and K-electric and as well as the policy binds all the public sector utilities. To recognize renewable energy technologies the policy introduced new inductive generation capacity expansion plan as a regulatory obligation of power system planning to upgrade the grid code for renewable energy projects. There is significant drop in the average basket cost generation for alternate and renewable energy technologies and non inclusion of capacity payments on projects tariffs. A major directional measure includes the displacement of expensive power generation thermal plants with the operation of alternate and renewable energy projects.

#### 4.7.1.8 Policy interventions

The import tax exemptions break the hindrance in the local equipment development. The policy shows intentions to engage the Chamber of Commerce and Industries to make a domestic renewable market and promote local industry by injecting more skilled and technical work force. To withdraw taxes and import duties exemption on plants and machinery, the policy demands such interventions from FBR on request of AEDB. The incentives are remain mute for local investors to manufacture alternative and renewable energy technologies. The respondent assured that AEDB supports the proactive measures and intervenes to remove such tax anomalies that create discrimination against local industries.

#### 4.7.1.9 Policy Integration

Renewable energy technologies have expected support of climate policy targeting mitigation and adaptation. A specific target of Alternative and Renewable Energy Policy 2019 is clean and eco-friendly energy through emission reductions under framework of UNFCCC. Development of renewable energy has wide implications as for energy sector alone, and energy policy must be integration of economic policy, climate policy, national energy conservation policy, trade policy, industrial policy, education policy and should alleging capacity building to enhance the multi benefits of local value chains development and job creations.

### 4.7.2 Institutional framework

The implementation of Alternative and Renewable Energy Policy 2019 requires specific and comprehensive institutional framework under defined national parameters. The institutional frame

of energy sector in Pakistan has a complex network encompass of AEDB and transmission and distribution utilities, power system regulators, federal and provincial energy departments, power project developers, development partners, technical and financial departments and academia. This complex network of energy infrastructure comprises of different institutions from generation to consumption that have deficient in functional and technical compatibilities. Indigenous renewable technology development, institutional infrastructure and capacity building are the challenges of alternate renewable energy technologies' in Pakistan.

CEO AEDB said that AEDB has a status of focal institution in the development of alternate renewable energy technologies in country. The board is dedicated to extend its proactive role in coordination, information, regulation, intervention, and supporting the alternative renewable energy technologies for off-grid, mini grid, localized energy systems, B2B, wheeling, net-metering, municipal authorities and entrepreneurs.

The respondent said that in Pakistan there are institutional flaws and such an irrational based overlapping in functions in institutional arrangements of energy departments. They have lack in financial and technical resources, low in infrastructural and professional human skilled force. The respondent considered critically the mandate of NEPRA. The respondent urged training based institutional and professional capacity to prepare brain drain of trained staff in energy market. The respondent also highlighted the role and importance of trained policy makers in understanding the results of different energy models and devising of short, medium and long term energy planning's and policies.

Policy lacks the underpinned resource renewable energy data. AEDB should produce and publish comprehensive renewable resource data based on international standards and statics. The resource data is helpful in designing specific policy measures and deployment cost. Improved and reliable data is important in assessment progress of actions plans and energy strategic objectives as well as in impact evaluation of effectiveness of policy measures and tools. AEDB should assign an authority to monitor the targets of renewables deployment, development, performance and cost effectiveness.

The role of AEDB should be an active change agent and make progressive interventions for promotion, penetration and indigestions of renewable energy technologies. The lack of skilled and untrained workforce is a major hurdle in implementation of renewable energy policy. The policy highlighted the importance of trained and skilled labor in the deployment of renewable technologies and guides the AEDB to establish a financially self-sustain institute of renewable technologies

under institutional framework and its sub-campuses across the country with cosponsor of academic and industrial stakeholders. The aim of institute is to encourage the research activities of renewable energy technologies for commercial operations and to create a need base and trained job market.

In the true democratic societies across the globe the institutions under the control of municipal authorities have legitimate and financial empowered status in order to deal with the civic and environmental concerns in parallel through public private partnership program. But in Pakistan the municipal institutions have never gain a strong position because of lacking in weak institutional framework and lack of political will. Policy is given holistic support that municipal departments may work by public private moods in alternate and renewable energy projects like solar parking, street lights, schools, mosques and basic health units lighting, and projects of waste to energy. Policy has given the task to AEDB to design competitive procurement scheme for municipal bodies and may offer assistance in structuring of project on demand. NEPRA will also be entertained the licensing and tariff regime under regulatory framework.

### 4.7.3 Implementation

AEDB informant said that before 18$^{th}$ amendment the power generation, transmission and distribution was the sole responsibility of federal government by WAPDA, but after the devolution plan of 18$^{th}$ amendment, under article 157 of constitution all provinces have empowered in devising their own policy, plan and infrastructural arrangements. Provinces are allowed to develop power generation projects at their own, transmission and distribution line up free from NTDC/DISCOs, tariff adjustments if alternate and renewable energy project is not added to national grid. The provincial energy departments and allied agencies have the benefit of direct contract with alternate and renewable energy project developers with complete financial autonomy. In competitive bidding process of federal procured utilities, the provinces will participate through making member of AEDB and steering committee; facilitate the bidding process making land availability in their own boundaries for incentivize location of alternate and renewable energy projects.

The respondent from AEDB said that the policy announces a foremost directional shift by setting up of practical steering committee for smooth coordination among all federating units and key stakeholders of energy management and operation in country. The steering committee performs its function as a sub-committee of AEDB. The structure of committee comprises following

i. An additional secretary of Ministry of Energy
ii. CEO AEDB

iii. Provinces Energy Secretaries
iv. MD NGC
v. CEO Market operator
vi. CEO System operator

The mandate of steering committee is to prepare reliable operating procedures allied with Alternative and Renewable Energy Policy 2019. The committee will also responsible to prepare provisional current year renewable energy procurement plan for fiscal year by 30th September of such year and submit it to the board for approval.

In future there will be system approach policy framework need to develop a well cooperated and fully integrated national energy plan focusing on renewable energy sector incorporating infrastructural support. The ownership frame of power market in country, the available renewable resources across the provinces, and constitutional powers that have provincial governments put emphasized on the integrated energy planning. The integrated energy plan will provide an analysis on policy options like future technological settings, capacity building, resource supplies, energy balances of demand and supply sectors, and also make competitive bidding process more efficient and sound. The respondent further suggested that the design of implementation mechanism should be on collaborative basis by the involvement of public and private sector stakeholders.

### 4.8 Identify Key Incidents

Pakistan has faced the energy and climate challenges. The fact and reality of energy crisis compelled the Pakistan to devise Alternative and Renewable Energy Policy 2019 focusing on power generation. Pakistan has done some constructive strives in renewable energy developments to overcome the power crisis. Nevertheless to enjoy the maximum benefits of renewable energy, there must be a vigilant policy slogan with successful implementation plan. A successful renewable energy system with the aim to increase generation capacity to get the target of electricity access requires a comprehensive policy framework that includes policy instruments such as fiscal and financial incentives, regulations, policy options of capacity building, public acceptance and awareness, market information, technical assistance, and quality standards.

The policy measures aimed the deployment of distributed renewables by displacement of bulk power houses with off-grid and localized energy systems and enhancing generation capacity to attain the target of electricity access. The policy asserts that decentralized energy solutions such as

off/mini-grids installations have vital importance in electricity access. One respondent expressed his views by saying that to accelerate the pace of energy access, policy support is essential in the deployment of decentralized stand alone renewable projects. Policy framework use tools like fiscal and financial incentives including carbon pricing, tax and import duties exemptions, regulations like auctions, feed in tariff and net metering. The fiscal and financial instruments and regulations support the renewable distributed generation and also make smooth the progress of investments in renewable power generation in country.

Pakistan long history of energy policies always secured the investors interests ignoring the long term targets of stability and sustained growth. For electricity to energy transition, there should pay accelerating attention on transformational impacts of society, institutional settings, financial costs, public ownership arrangements, and market revamp with the effective support and partaking of all stakeholders. Policy makers should use the necessary policy tools to exploit the full potential to break down the barriers in attaining wider energy transitions.

Furthermore, tariff determination mechanism should be on cost-reflective basis which involves the readjustment balances among volumes, fixed and demand charges. For small scale systems up to 100kW, tailored tariff regulations may use as an option in a way that operators can be allowed to set tariffs with the consultation of local community.

Full integration of renewable energy system under institutional framework is a solution of customer's needs and energy transition. Although the policy document has its significance and provide a support in the deployment of renewable energy technologies in country but on ground there still are certain barriers that slowdowns the full potential and development of renewables. The key barriers are immature technologies, high cost, low finances, infrastructural failure, poor institutional capacity, administrative flaws, overlap regulations, public acceptance and awareness. The institutional network is a major strength of implementation.

Policy gives much consideration and recommends measures and introduces regulatory tools and financial incentives on solar and wind projects and pay no attention to untapped renewable resources of solid waste management and geothermal and tidal.

### 4.9 Analysis of Practices in Particular Cases of Argumentation

The discourse analysis at this step return back to data to see the meaning of policy of what is to be said and what is to be a practice. After got official approval by cabinet in November 2019 and from Council of Common Interest in September 2020, implementation of policy is in action mechanism.

## 4.10 Interpretation

On the basis of in-depth interviews and rational deductions, following are the key notes and understanding of this discourse.

i. The policy lacks long term targets that may provide clear trend and vision to the market and industry. The long term targets have high dependence on the political will and always need policy actions for proper implementation. To achieve the policy measures stated in draft, there is need of complete collaboration, and broad consensus among all energy stakeholders and agencies.

**Policy Framework**

ii. The policy recommends different tools but each has its own strength and limitations. Auctions are flexible in design with prospective of actual price innovation but on the other hand it involves risk on underbidding and driven of small and new competitors out from market. The financial and fiscal incentives improve the technological affordability and assist the overcome the investment barriers. But due to frequent political priorities, there are possible variations in incentive support.

iii. Feed in-tariff and premium enables market incorporation of renewable energy and provides incentive to small-scale projects to generate electricity with low supply. The challenges include setting and adjusting of tariffs when cost structure varies robustly. Net metering has potential to offer savings both to the consumers and the system and also provide support in reduction of transmission and distribution losses. It has the risk that tariffs may not determine correctly the real value of electricity at each site and period.

iv. Our respondents by and large are disappointed with policy formulation process. Policy or plan should design with the aim to overcome the key barriers such as high cost of new technologies, insufficient energy infrastructure, and sustainability of energy system. The policy should push, encourage and improve the understanding of decisions for integrated energy plan among all stakeholders of energy system.

**Institutional Framework**

**v.** Policy is impressive in introduction of different policy instruments for successful and efficient renewable deployment in the country. But on other hand numbers of barriers

have been oversighted in policy document. Policy highlighted the lack of skilled work force and training programs but ignores the importance of reliable data and information about renewables function, operation, maintenance, development and performance. Thus policy has over looked awareness and capacity barriers. Similarly environmental features and an unsuitable location of project or without public acceptance and involvement, the renewable project may rise in cost or delays and even cancellation. The policy also over sighted the public acceptance and environmental barriers.

vi. NEPRA has introduced auctions as policy instrument. Policy not highlights the regulatory barriers of auctions and left the broad framework for NEPRA's role. The monopolistic role of NEPRA is highly condemn by few our respondents.

vii. All respondents agreed that policy lacks empirical data. For example, policy suggests the carbon taxes that can offer price signals and important in externalities reduction but implementation remain a challenge in competitive extensive energy markets and demand for tax exemptions.

**Implementation framework**

viii. Alternative and Renewable Energy Policy 2019 needs commitment that relates with institutional aspect in a way that policy vision should come from premier hierarchal ranks with clear implementation mechanism. Successful implementation of policy is hard because of ill institutional practices, absence of political will, out dated technologies, untrained and unskilled human resource, financial constraints.

ix. After the 18$^{th}$ amendment, the constitutional powers of provinces, the power market structure, and the renewable resources stretch across all the provinces emphasized that there is need of time to develop an integrated and well cooperated energy development plan based on comprehensive cost-benefit analysis of social, economic and environmental paradigm of renewables deployment in Pakistan and for this purpose the steering committee should come forward and play its active role by engaging all stakeholders from the provinces.

x. Community involvement through municipal bodies is a best practice to gain public support for renewables. Policy persuades the individual ownerships and profit sharing mechanism from renewables.

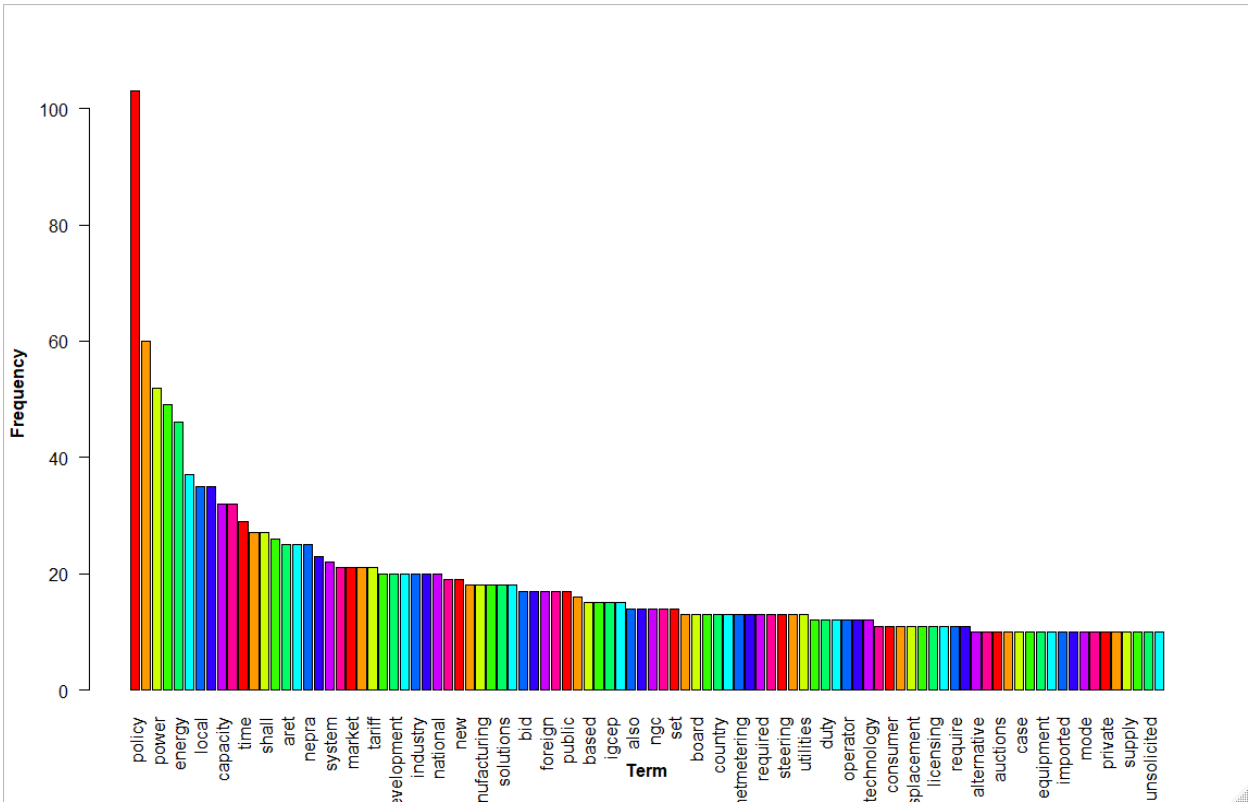
## 4.11 Text Analytics

In order to achieve the objective 03 of this study, we used text analytics as a tool to analyze the renewable energy policies of SAARC region. Following are the policies have analyzed,

**Empirical Findings of Alternative and Renewable Energy Policy 2019 Pakistan**

In raw form, Alternative and Renewable Energy Policy 2019 Pakistan consists of 30 pages, 115 paragraphs, 9281 words and 67069 characters. After detail text processing which includes removal of punctuations, numbers, white spaces, English stop words, there are 47737 characters left.

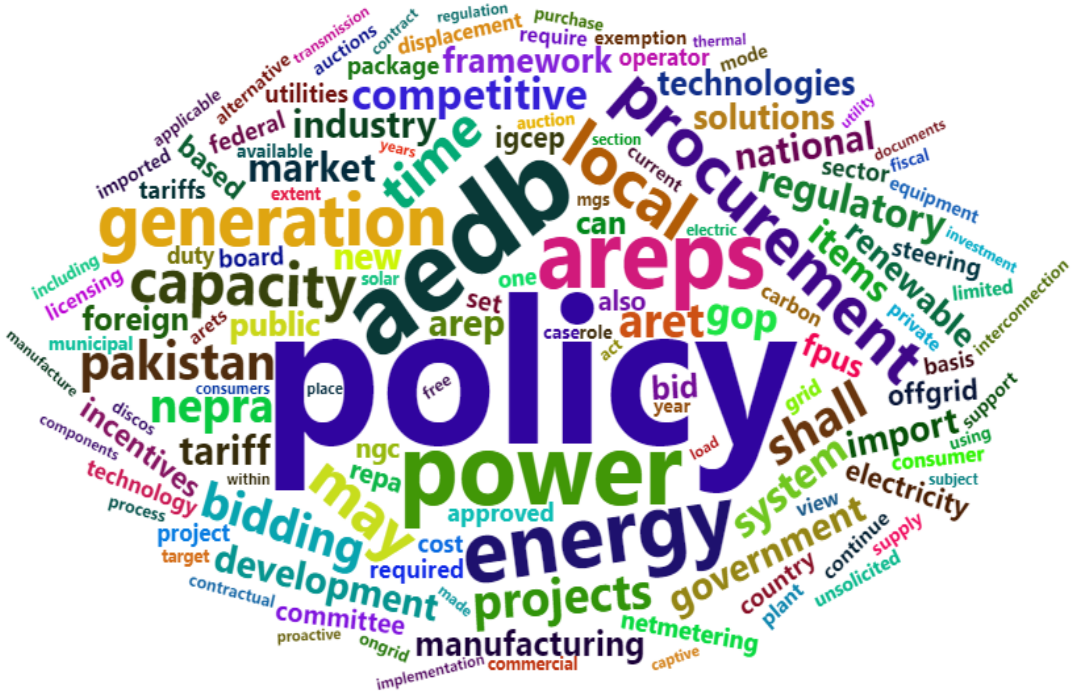
**Figure 4.1 Word Frequency plot of AREP 2019 Pakistan**




**Source; Compiled by author**

Figure 4.1 illustrates the lexical dispersion of the majority repeated terms in Alternative and Renewable Energy Policy 2019. The graph is showing the common words frequency in the policy document in such a way that each stripe shows the occurrence of a word, while each row represents the entire text. It describes that the word "policy" has more cluster and use from start to end of the document. The words like 'power', 'energy', 'capacity', have used maximum times in document. The terminologies like auctions, net metering, biding, licensing, have discussed in middle of the document. The word 'Pakistan' located in entire document with gaps.

**Figure 4.2 Word Cloud of AREP 2019 Pakistan**

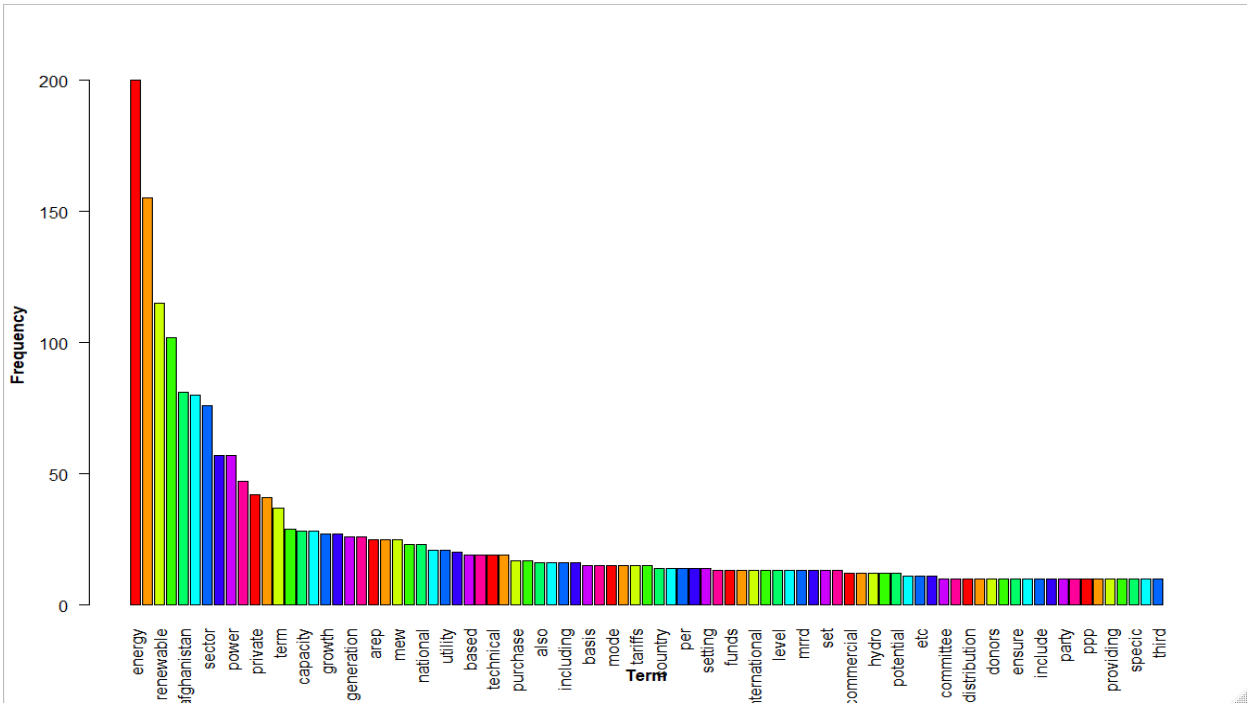



The world cloud with different colors and font size show the more frequent terms and words in the document. It illustrates that Pakistan has comprehensive and diverse agenda on alternate and renewable energy technologies. The document of Alternative and Renewable Energy Policy 2019 give more focused on power generation projects and off grid solutions by the use renewable energy technologies as policy options. The alternative energy development board has given the task to mobilize the local renewable energy market and increase the capacity of local manufactures within institutional frame. The policy advised NEPRA to determine tariff on incentive base and introduce auctions and procurement process through competitive bidding as major policy intervention. Nevertheless, Pakistan Policy of Alternative and Renewable Energy 2019 have covered the policy and institutional frames but weak in implementation strategy.

**Empirical Findings of Renewable Energy Policy 2015 Afghanistan**

In raw form, Renewable Energy Policy 2015 Afghanistan consists of 69 pages both in English and Afghan National language, 127 paragraphs, 11257 words and 133364 characters. After data cleaning, the left characters are 53823.

**Figure 4.3 Word Frequency plot of REP 2015 Afghanistan**




**Complied by author**

Figure 4.3 is a lexical dispersion showing most frequent terms in Renewable Energy Policy 2015. It illustrates that the word 'energy' has more occurrence in the document from top to end. The word like 'power, national growth, capacity are repeated frequently. The words 'hydro' and 'potential' are used in the middle of text. The word 'Afghanistan' appears 130 times in the text.

**Figure 4.4 Word Cloud of REP 2015 Afghanistan**

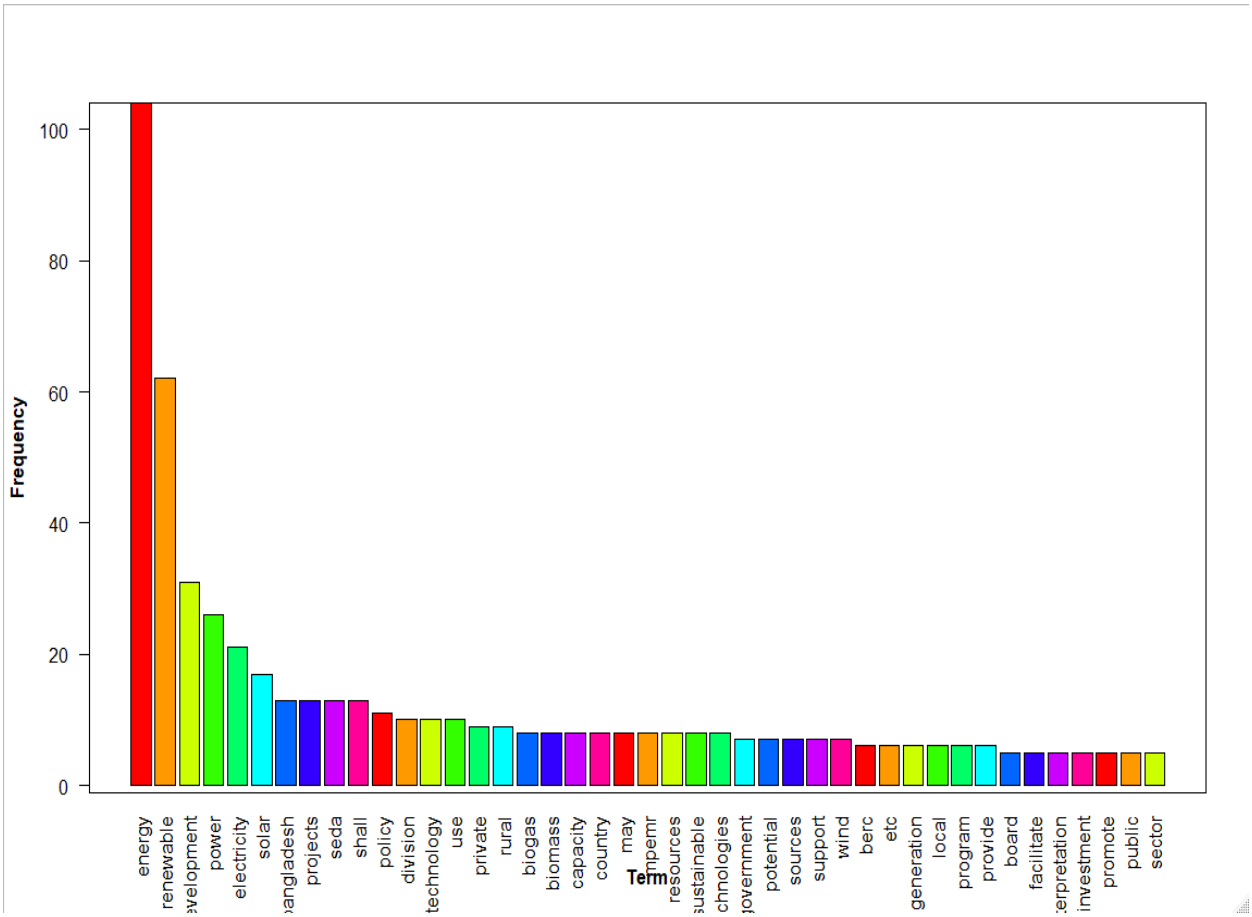

The word cloud shows that Afghanistan Renewable Energy Policy 2015 used renewable energy

resources as green energy. As compared to Alternative and Renewable Energy Policy 2019 of Pakistan, there are similarities between the two documents. As both the policies is more concern on power generation projects through renewable energy technologies. The common cloud in both policies consist of words like 'power', 'projects', 'energy', 'generation' 'development', 'electricity', 'utility'. The document lacks the role of institutions both public and private in the implementation of policy. In comparison with Alternative and Renewable Energy Policy 2019 Pakistan, the Renewable Energy Policy 2015 of Afghanistan lacks in diversity of renewable energy technologies and oversight the renewable electricity market.

**Empirical Findings of Renewable Energy Policy 2008 Bangladesh**

In raw form Renewable Energy Policy of Bangladesh consists of only 8 pages, 36 paragraphs, 2166 words, and 15763 characters. After data clean process there are 12474 characters left.

**Figure 4.5 Word Frequency plot of REP 2008 Bangladesh**

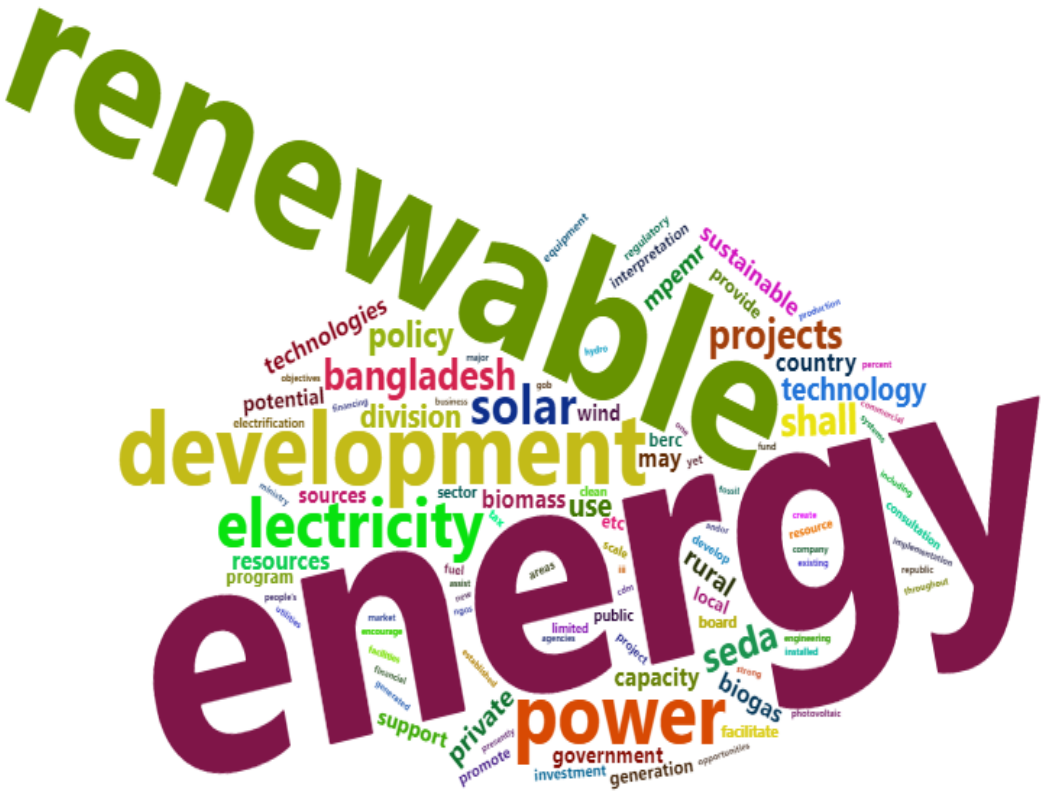



**Complied by author**

Figure 4.5 is lexical dispersion shows the word 'energy' as most repeated in the document. The

words like ‘power’, ‘electricity’, ‘solar’, ‘projects’, ‘generation’, are located in middle of document.

**Figure 4.6 Word Cloud of REP 2008 Bangladesh**

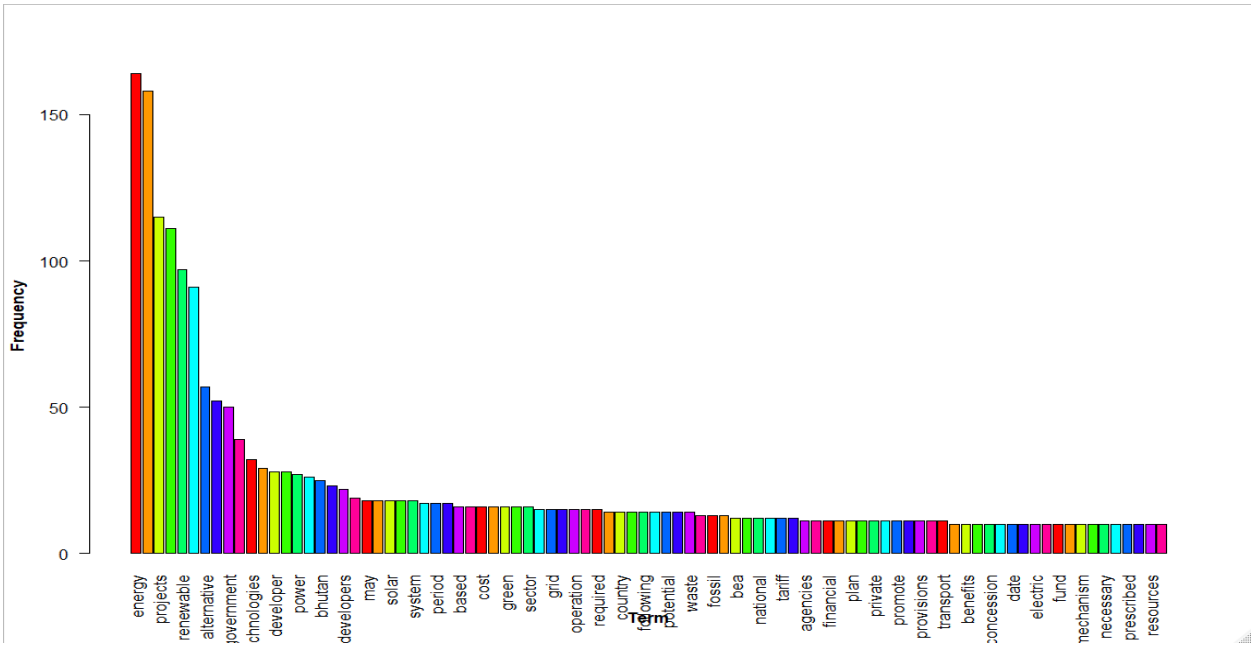



It is relative small word cloud but highlighted the importance of renewable energy technologies as sustainable growth for country. The cloud describes that policy is more centric in power generation from all the available renewable resources like solar, wind, biomass and biogas. The share of power generation from solar is relatively higher than other renewable energy resources in country. Although, the Renewable Energy Policy 2008 of Bangladesh is an old but not outmode document. The document depicts that an institutional arrangement named “Sustainable Energy Development Agency” (SEDA) with legislative stands has established. The SEDA works as a central agency for promotion and development of sustainable energy. In comparison with AEDB Pakistan, SEDA Bangladesh has more clear role and responsibilities. Both policies Alternative and Renewable Energy Policy 2019 Pakistan and Renewable Energy Policy 2008 Bangladesh have similar terms like ‘fiscal incentives’, ‘local and municipal governments’, and ‘regulatory’. The policy document lacks in implementation mechanism.

**Empirical Findings of Alternative and Renewable Energy Policy 2013 Bhutan**

In raw form, Alternative and Renewable Energy Policy 2013 Bhutan consists of 46 pages, 162 paragraphs, 8713 words, 62010 characters. After data cleaning, 46596 characters left in document.

**Figure 4.7 Word Frequency plot of AREP 2013 Bhutan**




**Complied by author**

Figure 4.7 is lexical dispersion showing the words of 'energy' and 'projects' with high frequency. The words like 'development', 'government', 'green', 'power', 'developer' and 'solar' are located in the middle of the document.

**Figure 4.6 Word Cloud of AREP 2013 Bhutan**

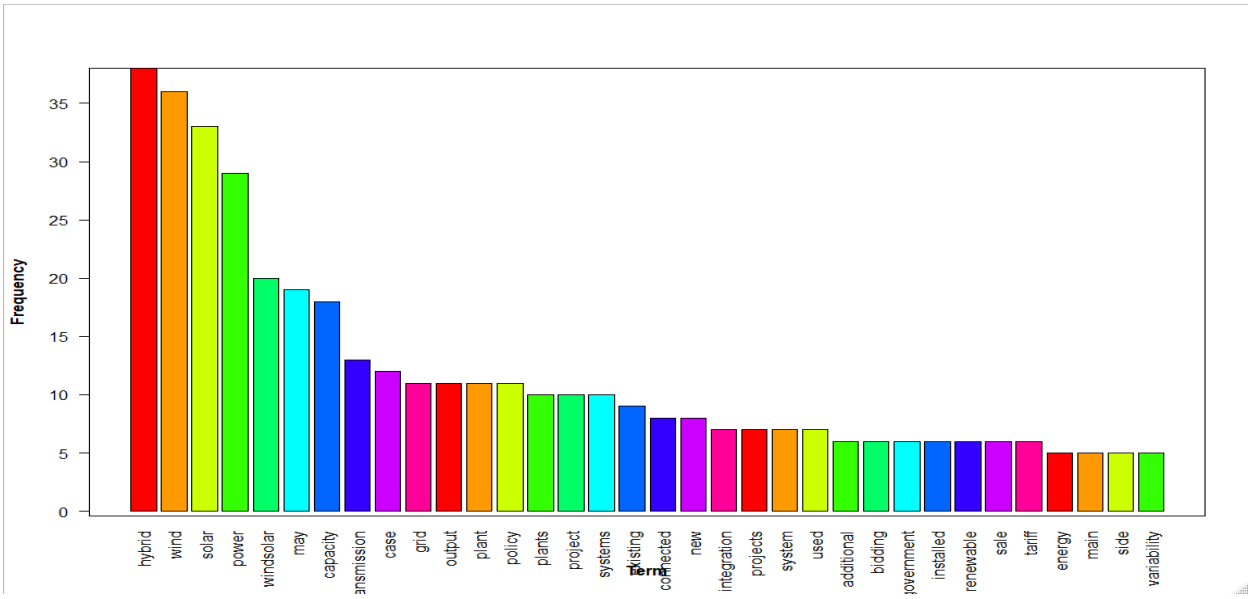

The word cloud of Alternative and Renewable Energy Policy 2013 Bhutan illustrates that it is a

substantial document and have enough stuff related to renewable energy. The policy document highlighted the alternative renewable projects developments. The document depicts a solid institutional arrangement as there is an inclusive fusion of different ministries and department of renewable energy (DER). In comparison with Alternative and Renewable Energy Policy 2019 Pakistan, Alternative and Renewable Energy Policy 2013 Bhutan has investment model for on-grid small renewable projects. The text describes that government of Bhutan has well managed implementation mechanism with monitoring and evaluation programs. Like Alternative and Renewable Energy Policy 2019 Pakistan, Alternative and Renewable Energy Policy 2013 Bhutan also focused on decentralized and standalone renewable energy projects. The document narrates that Bhutan has clear and broad fiscal incentive mechanism along with carbon market and delivery mechanisms. Alternative and Renewable Energy Policy 2013 Bhutan is much better and in depth document covers all areas from renewable resource allocation to transmission and distribution for the development of matured renewable technologies in the country.

**Empirical Findings of National Wind-Solar Hybrid Policy 2018 India**

In raw form, the National Wind-Solar Hybrid Policy 2018 India has 8 pages, 33 paragraphs, 1640 words, 11052 characters. 8447 characters left after data cleaning. This policy is precise as compared to AREP 2019 Pakistan and mainly focuses on solar and wind.

**Figure 4.9 Word Frequency plot of National Wind-Solar Hybrid Policy 2018 India**

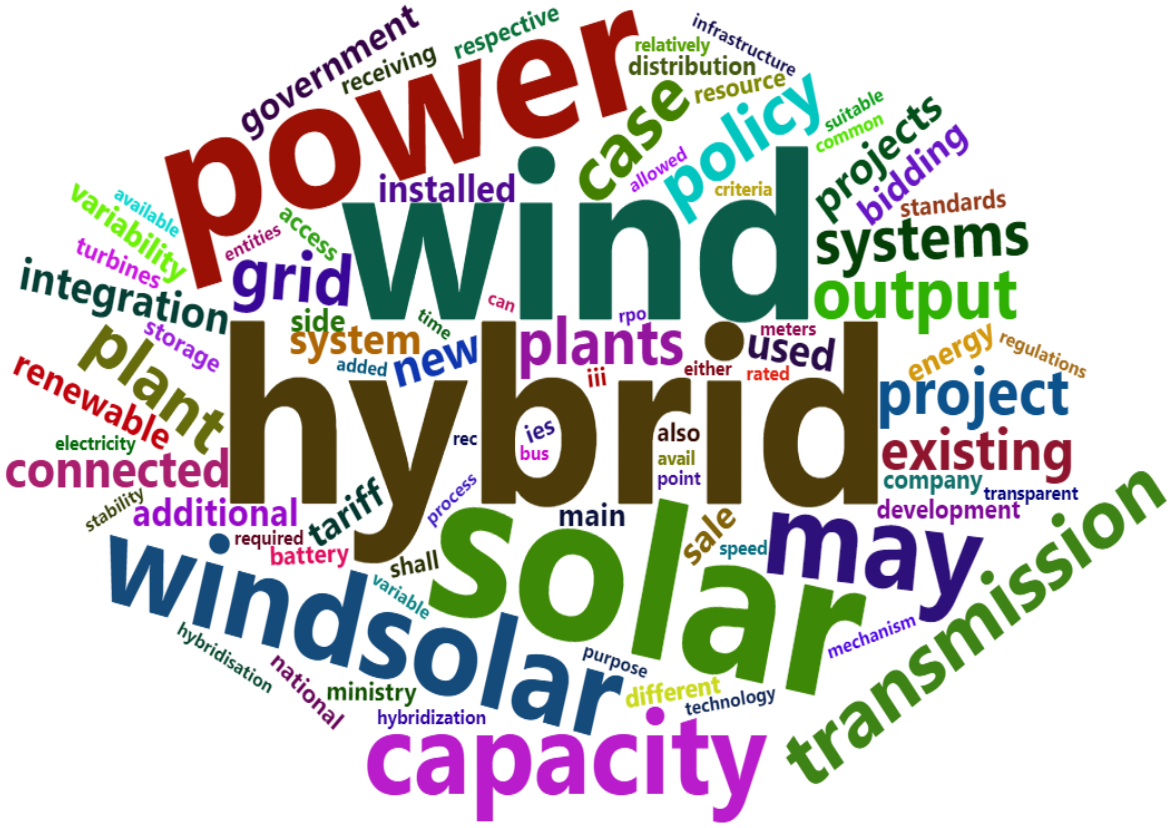



**Complied by author**

Figure 4.7 the lexical dispersion illustrates that the word ‘hybrid’ comes maximum times in the

document. The words ‘solar’, ‘wind’, ‘plants’, ‘projects’, ‘integration’, appears in the entire text with adjacent gaps.

**Figure 4.10 Word Cloud of National Wind-Solar Hybrid Policy 2018 India**

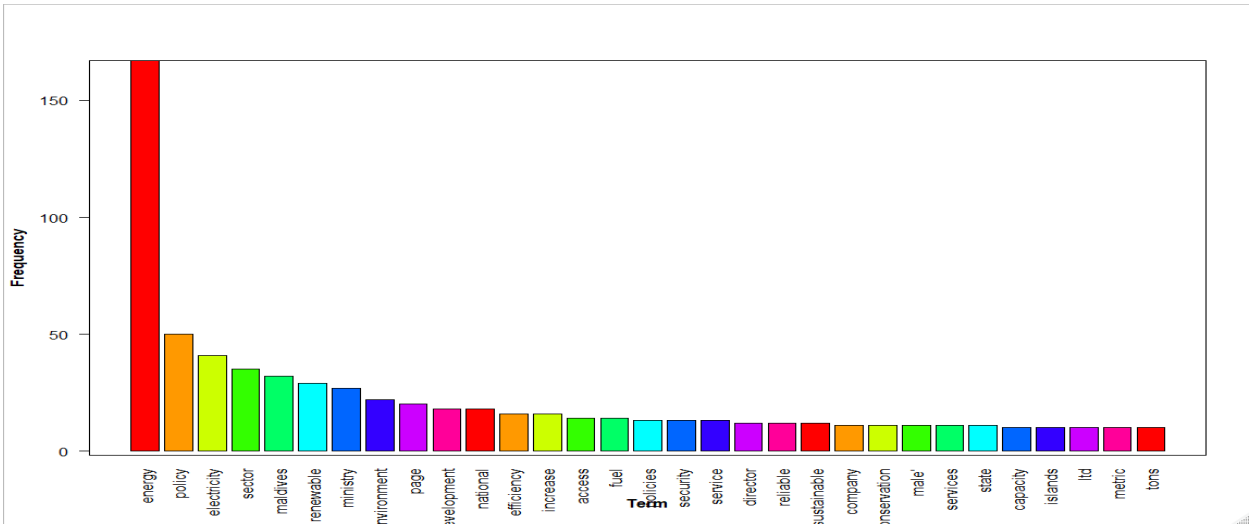



The word cloud clearly describes the agenda of the text. The policy mainly articulates the hybridization of solar and wind technologies in the country. The policy talks more on integrated grid infrastructure and standard transmission and distribution system. The document has clear implementation strategy. On comparison with Alternative and Renewable Energy Policy 2019 Pakistan, the Indian document lacks in institutional role, incentive plan and regulatory requirements. Both policies give importance on bidding process for solar and wind projects. Nevertheless, Alternative and Renewable Energy Policy 2019 Pakistan is more ample and extensive text by covering institutional, implementation and policy framework inclusively.

**Empirical Findings of Energy Policy and Strategy 2016 Maldives**

In raw form, Energy policy and strategy 2016 Maldives has 28 pages, 95 paragraphs, 8321 words, 20443 characters. After data clean process 17267 characters left.

**Figure 4.11 Word Frequency plot of Energy policy and strategy 2016 Maldives**




**Complied by author**

Figure 4.11 shows the lexical dispersion of word frequency. The word 'energy' appears from the start to the end of the text. The words 'electricity', 'efficiency', 'services', 'reliable' and 'sustainable' comes at regular interval in the text.

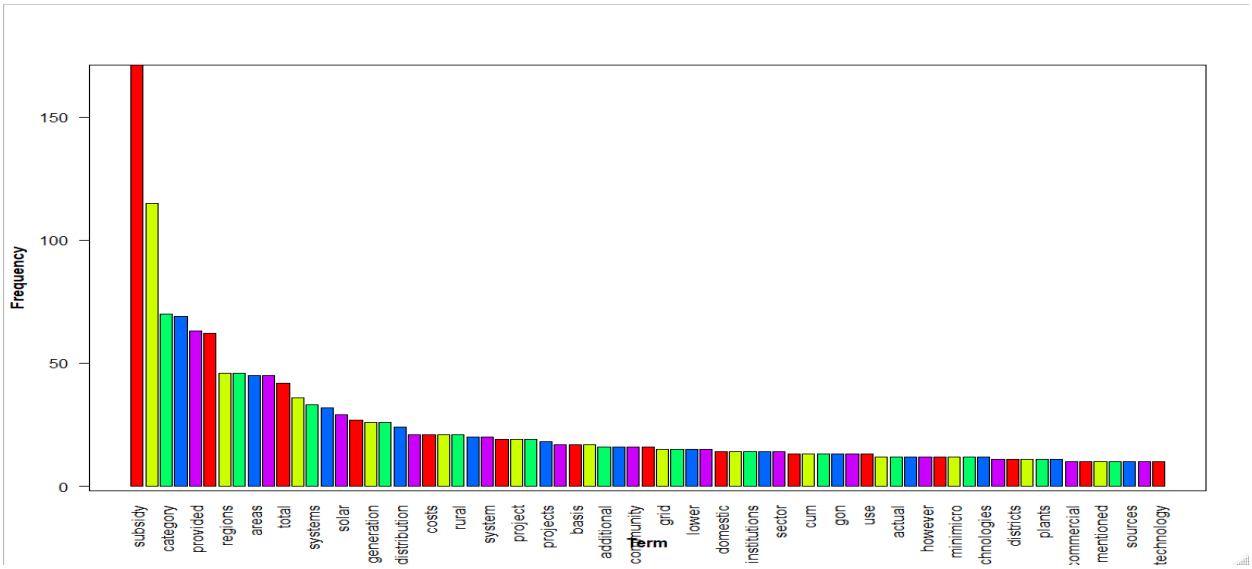
**Figure 4.12 Word Cloud of Energy policy and strategy 2016 Maldives**


The word cloud narrates that policy calls attention on reliable, efficient and eco-friendly renewable resources. The policy design shows that it is a blue print of sustainable development goal 7 (SDG-7). The document more or less describes different policy options. Like Alternative and Renewable Energy Policy 2019 Pakistan, the policy is committed to strengthen the institutional capacities, regulatory framework and for promotion of renewable energy technologies in the country.

**Empirical Findings of Renewable Energy Subsidy Policy 2016 Nepal**

In raw form, Renewable Energy Subsidy Policy 2016 Nepal has 17 pages, 104 paragraphs, 6268 words, 41532 characters. 31813 characters left after cleaning process.

**Figure 4.13 Word Frequency plot of Renewable Energy Subsidy Policy 2016 Nepal**




**Complied by author**

Figure 4.13 represents lexical dispersion of term frequency. The word 'subsidy' has maximum number of frequency in the entire document. The words 'generation',' distribution', 'system', 'domestic', 'institutions' and 'commercials' are used in the middle of text with frequent intervals.

**Figure 4.14 Word Cloud of Renewable Energy Subsidy Policy 2016 Nepal**

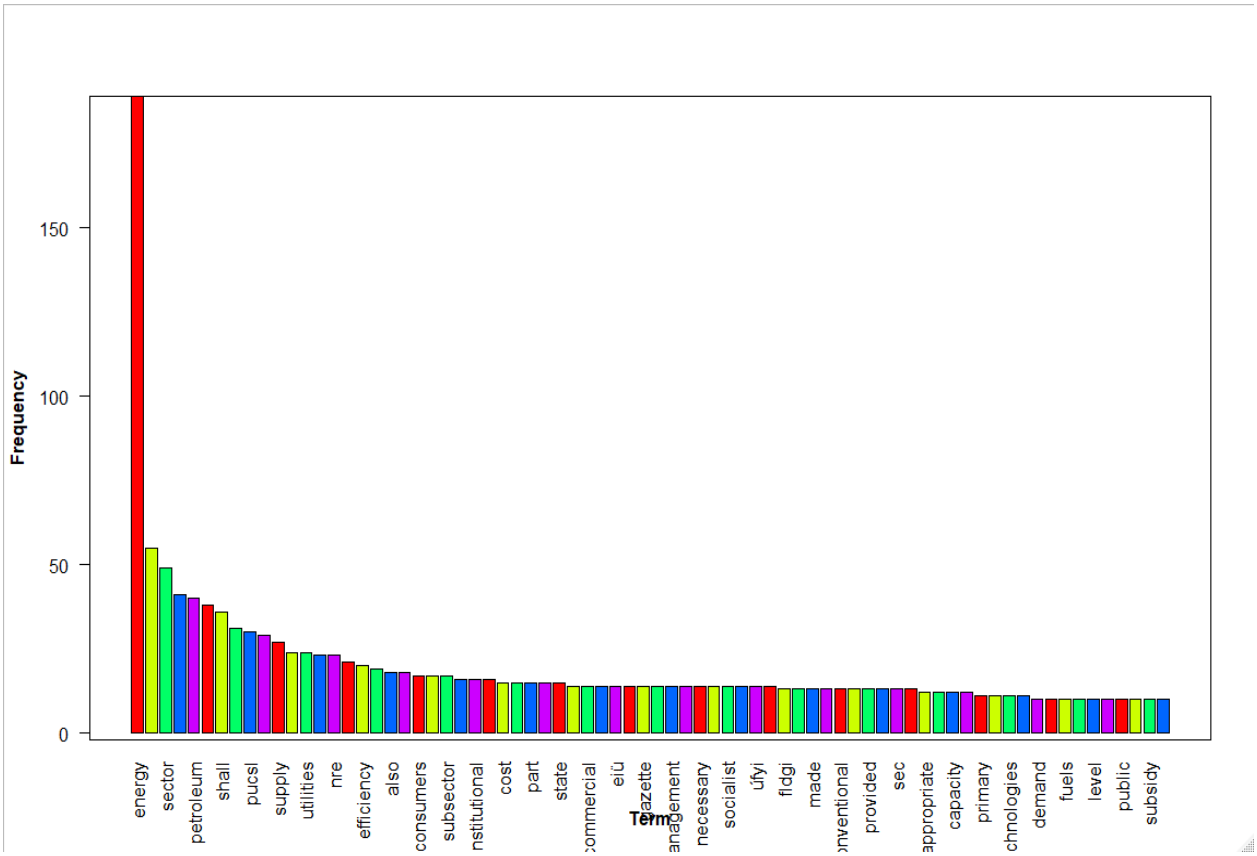

The word cloud highlighted with the word 'subsidy'. As it indicates that the state grants some

financial benefits to households for different renewable energy technologies. The subsidy cost varies from region to region depends on renewable energy technology. A comparison of Alternative and Renewable Energy Policy 2019 Pakistan and Renewable Energy Subsidy Policy 2016 Nepal, both policies give importance to local community involved renewable energy projects. Both policies introduce carbon credit mechanism. Like Alternative Energy Development Board (AEDB) in Pakistan, the Alternative Energy Planning Centre is responsible to provide financial and technical assistance to access renewable energy technologies.

**Empirical Findings of National Energy Policy and strategies 2008 Sri Lanka**

In raw form, National Energy Policy and Strategies 2008 Sri Lanka has 13 pages, 117 paragraphs, 5617 words, 43815 characters. After cleaning data 35284 characters left in the text**.**

**Figure 4.15 Word Frequency plot of National Energy Policy and Strategies 2008 Sri Lanka**




**Complied by author**

Figure 4.15 shows the lexical dispersion of word frequency in the document. The word ‘energy’ with maximum frequency appears in the text. The terms ‘petroleum’, ‘utilities’, ‘consumers’, ‘institutions’, ‘capacity’ and ‘subsidy’ are appears in middle of the text.

**Figure 4.16 Word Cloud of National Energy Policy and Strategies 2008 Sri Lanka**


The word cloud shows it is a broad energy policy with some specific targets of renewable energy. It shows that the text calls attention to the electricity generation from the renewable energy resources. The policy has clear institutional role with implementation strategies. In comparison with Alternative and Renewable Energy Policy 2019 Pakistan, this Sri Lankan document is general energy policy, while the Pakistan's document is specific to renewable energy resources.

Energy security is a major challenge in the progress of SAARC region as it is over populated region of world. According to World Bank (2014), SAARC region is the second fast growing region in the world. But on the aspect of energy facilities and services most of the SAARC nations depend upon the single source of power generation. SAARC region has enormous prospect of renewable energy resources.

**Table 7 SAARC Renewable Energy Potential (MW)**

| Country | Hydro | Wind | Solar kWh/m/day |
|---|---|---|---|
| **Afghanistan** | **27,000** | **200,000** | **7** |
| **Bangladesh** | **550** | **0** | **6** |
| **Bhutan** | **40,000** | **0** | **5** |
| **India** | **220,000** | **150,000** | **6** |
| **Maldives** | **0** | **0** | **5** |
| **Nepal** | **95,000** | **0** | **5** |
| **Pakistan** | **65,000** | **145,000** | **5.7** |
| **Sri Lanka** | **3,000** | **29,000** | **6** |

Source; IRADe

A study explores some positive impacts of renewable energy consumption with increased in the

economic growth in SAARC countries (Rahman & Velayutham, 2020). In another study about causal link between renewable energy, environment degradation and economic growth in SAARC region finds that GDP has increases and carbon emissions decreases with renewable energy production (Zeb et al., 2014). There are certain bottlenecks like policy, economic, technical, quality data and human resource for competition of renewable energy technologies in SAARC region. SAARC has Inter Government Framework Agreement for regional energy cooperation and in 18$^{th}$ SAARC summit in 2014; the member nations signed the framework of setup of regional energy grid to share electricity from common grid (Iftikhar, Najeeb, Mohazzam, & Khan, n.d.). It is needed to harmonize legal and regulatory frameworks, develop quality energy database, establish financial roadmap, and improve institutional capacities for SAARC regional energy trade and cooperation agreement.

The text analytics of this study portrays that all the renewable policies of SAARC region have mainly focused on power generation for electricity purpose. Among SAARC nations Afghanistan is lagging in funds from international donors to uphold its capacity building for renewable energy technologies and local experts. Bangladesh has robust legal framework as Bangladesh Energy Regulatory Commission (BERC) has the regulatory mandate for energy sector and it played a vital role to attract private sector investments. Bhutan's government is more vigilant and responsive towards green and clean energy. The Bhutan's document is a guiding roadmap for rest of SAARC nations as it exhibits firm institutional arrangements and inclusive implementation mechanism. India is the only country of SAARC region has Ministry of New and Renewable Energy. Nepal subsidy policy is a major achievement in developing of renewable energy market and investment mobilization. The Alternative Energy Promotion Centre (AEPC) Nepal is responsible in provision of all types of technical and financial support for decentralized renewable energy technologies. Maldives renewable energy road map is a collinear with the environmental concerns and an attempt to attain the SDG 7 goal. Pakistan has comparatively better institutional setup than other SAARC countries, Pakistan owes NEPRA as regulatory body and AEDB aims to promote renewable energy technologies. Sri Lanka has clear institutional role with implementation strategies. The word cloud of Pakistan, Sri Lanka, Nepal, and Bhutan policies illustrates that these are attentive in employment generation through small renewable energy projects by the involvement of local communities as well as by upgrading the domestic industries and renewable energy markets. The commitment of SARRC countries in adaption of alternate and renewable energy will decrease the carbon emission in the region.

# CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

## 5.1 Conclusion

After the detailed analysis of different documents and application of Hajer's framework on Alternative and Renewable Energy Policy 2019, and text mining of SAARC renewable energy policies, it is concluded that the formulation of Alternative and Renewable Energy Policy is robust and remarkable step of government of Pakistan in the adoption of renewable energy technologies for affordable energy, to gain the momentum of sustainable economic growth and tackle the climate challenges. The document focused on adoption and promotion of policy measures for deployment and development of all alternative and renewable technologies and sources primarily solar, wind, biogas, small hydro, geothermal and solid waste. Policy acknowledged improvement of institutions role and capacity in terms of skills and training to human resources collaborated with international donors as it is highlighted that lack of skilled work force and training programs in renewable energy sector. Policy ignores the importance of reliable empirical data and information about renewables function, operation, maintenance, development and performance. Despite the overwhelming policy development has done in recent decade in renewable energy technologies, Alternative and Renewable Energy Policy 2019 is an admirable plan but there is enough room for perfections because of persist barriers and new challenges. Alternative and Renewable Energy Policy 2019 is in implementation phase but without robust implementation mechanism.

## 5.2 Recommendations

Some improvements of Alternative and Renewable Energy Policy 2019 based on our discourse are presented

- The policy demands a comprehensive research work and analysis from researchers covering all perspectives of economic, technical and social process on rational grounds in identifying certain loopholes and shortcomings to improve the status of Alternative and Renewable Energy Policy 2019.
- There are some genuine concerns of provinces on the role of steering committee. It is suggested that the role of steering committee should be collaborative and guiding rather than controlling and directing for successful implementation.
- Public awareness program should be design with the support of media campaigns with aim to educate the end-users of electricity about the benefits of renewables and their impacts on

communities-development, local-economics, emission-reduction, air-quality and climate-resilience.

- Policies should be transparent and stable. To push the mainstream renewables in energy market, the set targets in policy should be realistic, well defined, legitimate, and time bounded with self enforcement implementing mechanism to translate into projects.
- As analyzed that policy oversights the market structure and mechanism for renewable energy sector. There should be a proper market design that encourages the competition, innovation and investments in renewable energy sector.
- This discourse analyzed that there is lack of empirical data. AEDB should publish comprehensive renewable energy data on basis of resources, technologies, costs and policy mechanisms with the collaboration of international energy statistics.
- There should initiate HRD by introduction of RET's courses at all level of education from secondary to post graduation along with innovate base salaries to the RET's professionals.
- Renewable portfolio standards (RPS) is one of the best regulatory tool should be practiced in country along with its analysis of energy, economy and environmental implications.
- To support the renewables procurements, innovative and emerging policy options like virtual power purchase agreements, utility green tariff scheme, and green premium products under voluntary programs that are adopted in various countries should also be exchanged among SAARC countries.
- Innovative experiences among SAARC nations should be exchanged in adaption of novel technologies as well as for fiscal incentives for promotion of renewable energy technologies.
- SAARC nations should take forward initiatives to design a mechanism of local entrepreneurships as Sri Lanka engaged business, research and local communities.
- There should be integrated computer technology and artificial intelligent energy management system in SAARC countries.

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## Annexure A

### Helicopter Questions

Q 1. What is your stance regarding the importance of analysis and evaluation of Alternative and Renewable policy (AREP) in academic circles?

Q 2. Do you think Alternative and Renewable policy (AREP) of Pakistan developed at the right time and the proposed measures in the policy are sufficient and appropriate?

Q 3. In your opinion are these policy measures realistically established and have solid background to be the part of the policy?

Q 4. Considering Pakistan's energy deficit, do you think the proposed measures will able to manage the energy crisis effectively?

Q 5. IRENA emphasizes on three fold strategy that is energy, economy and environment for handling the issue of fossil fuels. Do you think in case of Pakistan they are equally important or one of them is most important?

Q 6. In your opinion what are the best policy options for promoting consumption of renewables in Pakistan?

Q 7. Being a renewable energy expert and having vast experience in the area where you see the hurdles in the policy and why you think so?

Q 8. It is a fact that institutions have to play an instrumental role for proper implementation of any policy. Do you think Pakistan has enough and capable institutes to implement the policy or the policy give due consideration to this aspects?

Q 9. Does the policy stance on implementation mechanism is clear and attainable?

Q 10. Do you think the 18th constitutional amendment will cause an impact on Policy and what could it be?

Q 11. Are you satisfied with the process of consultation with different stakeholders while formulating the policy? You/ your organization have a specialty of working in area of renewable energy, were you consulted during the process of policy formulation? What were your primary concerns about the policy and were they addressed?

Q 12. Pakistan has formulated two policies regarding the renewable energy in past but failed to implement them successfully, where you see this policy with respect to its implementation?

## ANNXURE B

## QUESTIONS FOR INTERVIEW

### A Policy framework

Q 1. How a policy maker decide which policy instrument is best for country?

Q 2. What policy options that we have to attain an affordable economically and environmentally sustainable energy supply in country?

Q 3. State-level renewable energy policies are often adopted with a range of legitimate, although sometimes conflicting, policy objectives. What policy tools should adopt by the States to minimize the conflicts among policy objectives?

Q 4. What are the policy parameters that you suggest to move from electricity transition to energy transition?

Q 5. Policies are being considered as the instrument in encouraging the investments and in stimulating the rapid growth of the renewable energy sector however, investment level in the renewable sector is not so high to reach the policy target. What are the policy interventions should adopt by the government to cater the investment trend?

Q 6. What are the areas of policy intervention relevant to the system integration of renewables in global reference?

Q 7. Do you think the policy framework should need to take a system approach with more full integration of policies across sectors like climate, transport?

Q 8. As the costs for renewable technologies fall, what are the driving policy actions which may evolve and adapt the diverse benefits of renewables?

### B Implementation

Q 9. Pakistan has formulated two policies regarding the renewable energy how much you are sure this policy will be implemented? Where do you see the hurdles?

Q. 10 Apart from financial resources, we also need enough trained human resources who are to deal with and understand the technical as well as economics of renewable energy, where is this capacity going to come from?

Q11. After 18th constitutional amendment the subject of energy was devolved to provinces. What impacts will this decision have on the policy in the long and short term?

Q12. It is recommended research in area of renewable energy would be enhanced. Are you satisfied with the current research in area of renewable energy in the country?

Q13. The policy measures outlined are broad based and general. Who will and when will actual targets and timelines be set towards achieving them?

**C Institutional capacity**

Q 14. Will decentralized renewable energy solutions play a key role in achieving universal access to modern energy services in Pakistan?

Q 15. Do you think that technology, awareness and capacity, cost, finance, infrastructure and public acceptance, regulatory, institutional and administrative are barriers in addition to policy?