AN ANALYSIS OF PAKISTAN RENEWABLE ENERGY POLICY

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A Dissertation submitted in partial fulfillment of the

Requirements for the degree of

M.PHIL IN POLITICS AND INTERNATIONAL RELATIONS

Department of Politics and I.R

(Faculty of Social Sciences)

International Islamic University, Islamabad

2014

Foreign relations
World politics

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I, Sidra Najeeb, hereby declare that this dissertation is original and has never been presented in any other institution. I, moreover, declare that any secondary information used in this dissertation has been duly acknowledged.

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ACKNOWLEDGEMENT

First of all, I am grateful to Allah Almighty who gave me the courage and ability to complete my work.

I owe my most sincere gratitude to my supervisor and my mentor, respectable Dr Noor Fatima, whose support and belief helped me to accomplish this work.

I am heartily grateful to my teachers, Dr. Husnul Amin, Dr Manzoor Afridi, Mr. Azhar Shahbaz, Mr Rizwan Sharif and Ms Saira Bano who kept me supporting throughout my degree.

I am also grateful to NEPRA , AEDB and REAP for their support and who provided me the access to the significant material related to my area of research.

My sincere and special thanks to my mother for her prayers and immense love, which kept me going through out my academic life.

My warm and loving thanks to my husband Usman, and my in laws, who kept me motivated throughout my research work.

My sincere thanks to my dear sisters, Sara, Amna and Maryum whose loving support encouraged me to complete my work. I also sincerely thank my brother Waqas for supporting me immensely.

I am thankful to my friends Irsa Shafiq ,Musharraf Sultana and Samina Rehmat for their continuous support throughout my research work.

Lastly, I offer my special thanks to my Baba, who is not with me but still I can feel his blessings around me.

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ABSTRACT

This research is intended to build a thoughtful analysis of renewable energy policy of Pakistan. Pakistan being a developing state is facing grave challenges in the energy sector. One of the ways to overcome these challenges is to diversify state's energy mix, by developing and formulating renewable energy (RE) sector. One of the major break through for Pakistan came when the first concrete step by the Government of Pakistan was taken in 2006, by forming its first ever renewable energy policy. The policy aimed to achieve energy security, economic benefits, social equity and environmental protection .The policy provided all the incentives to develop the particular sector but the results of the policy couldn't be achieved except for few eliminatory projects. Later in 2011 the policy was replaced by another midterm renewable energy policy but the results have remained the same. Thus the study will try to figure out that besides the potential in the renewable energy (RE) sector and critical need for the development of renewable energy (RE) along with the policy intact why Pakistan has not achieved a major breakthrough in this area .Thus it will provide a deep analysis of the challenges and the barriers Pakistan is facing in the implementation of the renewable energy (RE) policy and renewable energy (RE) sector.

List of Figures/Tables:

List of Acronyms:

ADB: Asian Development Bank

ARE: Alternative and Renewable Energy

AKRSP: Agha Khan Rural support Program

BTU: British Thermal Unit

CNG: Compressed natural gas

CDM: Clean development mechanism

EIA: Environmental Impact Assessment

EPA: Environmental Protection Agency

ENERCON: National Energy Conservation Centre

FESCO : Faisalabad Electric Supply Company

GHG: Green House Gases

GDB: Gross Domestic product

GEPCO: Gujranwala Electric Power Company

GOP: Government of Pakistan

GTZ: Deutsche Gesellschaft für Technische Zusammenarbeit

HDIP: Hydrocarbon development Institute

HESCO : Hyderabad Electric Supply Company

IDCOL: Infrastructure development company limited

IESCO : Islamabad Electric Supply Company

IGO:International governmental organization

IESE:International Solar Energy Society

KANUPP: Karachi nuclear power plant

KESC:Karachi electric supply company

KWH:kilo watt hour

LNG:Liquefied natural gas

LPG:Liquefied petroleum gas

LESCO: Lahore Electric Supply Company

MDG:Millennium development goals

MW:Mega Watts

MEPCO: Multan Electric Power Company

NGV:Natural gas vehicles

NTDC:National transmission and distribution company

NFDC:National Development Finance Corporation

NEPRA:National Electric Power Regulatory Authority

OPEC : Organization of the Petroleum Exporting Countries

OGRA Oil and Gas Regulatory Authority

PV:Photovoltaics

PAEC:Pakistan atomic energy commission

PPDB: Punjab power development board

PCRET:Pakistan council of renewable energy technology

PESCO : Peshawar Electric Power Company

PPIB: private power infrastructure board

PEPCO Pakistan electric power company

QESCO : Quetta Electric Supply Company

REAP:Renewable and Alternate Energy Association of Pakistan

Chapter One

Introduction

"The amount of energy is finite ..... And competition for access to energy can become the life and death for many societies

(Hennery Kissinger)

Perhaps it won't be untrue if the twenty first century is called the energy century. The reasons for the statement are various. The ever increasing growing demand of energy in the world on one hand, and the depleting sources on the other have pushed the states to think about their future in terms of energy. Thus the notions like energy sustainability, energy security are the dominant features for all the policy makers in the world. (Peimani, 2011)

Energy is not only considered as one of the major inputs in all the economic activities but it has also been considered as one of the fundamental foundations of welfare and well being of the people. It is considered as the most vital element and the driving force behind industrial and technological evolution of mankind. It is also known to be a key quantitative indicator to roughly gauge the level of advancement that are achieved within a civilization and industrial activities of a nation. (Organization for Economic Cooperation and Development and International Energy Agency, 2011)

Replacing manual and animal labor by exploiting energy sources provided the platform for industrial revolution. Two centuries ago, the world was introduced by the miraculous usages of black coal- an energy rich hydrocarbon and the large scale industrial revolution took pace. Just a century later, oil and gas were added to satiate the thirst of growing

industries. And that's when the huge beginning of energy consumption started. (Chow et all, 2003)

Thus the twentieth century witnessed an exceptional change and expansion in terms of industrialization, population growth, energy consumption and economic outputs. Initially this development was restricted only to the few western states, but as the time passed it became a global phenomenon and countries like India (6.4 percent growth per year) and China (10.4 percent growth per year) on the embark of twenty first century were placed in the world's top economies. The foundation for all this development was "energy or fossil energy". When analyzed it was realized that the increased dependence of the countries on energy resources and energy availability and quick accessibility have become critical shapers and movers of the modern economies. (Simon, 2007)

According to IEA report on "Energy Outlook", throughout the world energy demand has been increased. And it will continue to increase as the developing countries like India and others are on a roller coaster ride to be placed in the list of the developed nations. (International Environment Agency, 2013)

Looking at the global energy map it will be realized that the total energy requirement around the globe has exceeded. According to EIA, the world energy consumption will increase to sixty five percent by 2040. (Environmental Impact Assesment, 2013).The global energy mix constitutes of fossil fuels, nuclear and renewable. Fossil fuels 81.3 percent, nuclear 9.7 percent and renewable contributes to 9.5 percent. The oil consumption only in the year 2011 was 3633 Mtoe. (IEA, 2013) With this increased importance and consumption of fossil fuels, many scholars, environmentalist, policy

makers have raised several questions on the fossil fuel availability and have identified various other issues.

Though it will be untrue if it is said that fossil fuels will finish tomorrow, but this going to be a reality one day. They are depleting really fast. Moreover, more than their depletion, the real concern about the fossil fuel is its monopolization in few countries. According to some studies the rapid ratio of energy demand, the supply of energy fuels can scarcely decline in next 20 years. This decline can lead to competition, economic instability and conflicts around the globe. The question of oil and supplies presuppose a great importance to world politics particularly according to current dynamics (Randolph and Masters, 2008) If we properly characterize the problem, despite of its limited availability, the world does not face any instantaneous threats of running out of fossil fuel reserves. The problem instead is that these reserves are concentrated in a small number of countries and dominantly monopolized by superpowers due to their political influence, and price control. Moreover the oil companies act as a key player in exploitation of less developed countries by exporting it at high prices.

Oil is such a precious asset that economic development can led to numerous oil wars and great games among key players in oil rich regions. During 1990, the cost of oil per barrel was about $15 and in short span of two decades the prices increased more than $100. Numbers of underlying reasons behind it were incorporation of energy extensive technology leading to increased demand, Gulf wars and turmoil of Middle Eastern region. Intergovernmental organizations such as the Organization of Petroleum Exporting countries (OPEC) emerged as an important IGO, which got a strong monopolistic hold over resources. During 1990s, OPEC began to advance its position as a stake holder in

international economic scenario. by manipulating supplies and prices. As a result, Oil process tripled within a year, showing that OPEC can still make oil a critical global issue through price control, as an instrument of coercive diplomacy to stretch its influence in the course of unfolding war on terrorism, and regional conflicts particularly within Middle East. (Randolph and Masters, 2008)

Along with these problems, another challenge associated with fossil fuels is the environmental issues. One of the main issues in this is the emission of green house gases. Burning of the fossil fuels produces the carbon dioxide gas, which increases the green house gases which in turn increases the temperature of the earth. According to a research, the carbon dioxide concentration in air before industrialization was 280 ppm, which rose to 315 ppm in the year 1958 and became 350 in 1985. The amount has doubled in the twenty first century rising to 700 ppm. If the trend continues the earth's temperature will be increased three fold causing evaporation of the water in seas and oceans, melting of snow, these are the issues encompassed under climate change and global warming. (Environmental problems with coal, oil and gas, 2013)

According to the global issues research, the burning of fossil fuels is generating two distinct problems. Emission of carbon dioxide causing global warming, while emission of the byproducts causing global dimming (dimming of the sunlight).

According to the Centre for Biological Diversity, only in the United States of America, the use of fossil fuels contributes 86 percent of the total green house gases. Carbon dioxide contributes 98 percent. So only the USA emits 4.5 percent of carbon dioxide in the atmosphere. Other related issue with respect to this is the acid rain challenge and air pollution. (Casper, 2010)

More over the use of fossil fuels has questioned the "sustainability factor" in the energy equation. Since the definition of sustainability is "development patterns that meet the needs of the present without jeopardizing the future", thus the significant part in this definition in the context of energy is its availability in the future. As discussed earlier, the huge challenge for the fossil fuels is its depletion and its future availability. Hence the world cannot rely on the fossil fuels for the sustainability.(Casper,2010)

This has pushed the policy makers to look for some alternative, which would help in mitigating the above mentioned challenges. Therefore the concept of "Renewables or Renewable Energy" which was somewhat dormant in the policy circles has gained popularity and has become a key concept presently. No other concept is seen with such optimism as the concept of renewable energy has been seen by the policy makers. They view that the energy and economic challenges of the twenty first century can only be met if renewable energy is adopted and implemented in an honestly manner.(Konrad-Adenauer-Stiftung and East West Institute,2007)

RE as compared to the fossil has numerous advantages. These advantages are not only limited to the environmental and financial and sustainability benefits, rather a number of social benefits can be drawn from the use of renewable energy.

Renewable sustainable energy is important for improving energy efficiency, low cost provision of electricity and making it available even in rural areas for balanced economic growth in urban as well as rural parts. Providing de-centralized energy-option, it will also encourage the rural energy-production, and developing new institutional structures.

Among many other RE benefits, economic benefits are the significant one. According to some scholars economic benefits is one of the keys to develop RE .The US department of

Energy in their report has discussed two key economic benefits that RE can produce .One is that RE is labor intensive (hence creating jobs direct, indirect and induced) second since indigenous resources are used which means energy dollars are kept at home.(US Department of State, 1997)

RE environmental benefits are also vast. It pushes decreased deforestation, a cleaner environment, and preservation of the eco systems. This will decrease the GHG emissions, trim down the global warming and will reduce the natural disasters and climate change. Thus a better living environment will be formed. (Abbasi & Abbasi, 2008)

Renewable energy is not only one of the best options for the developed states for their sustainable growth but can equally play a key role in the developing states. Where besides rapid growth throughout the world, people are still living below the poverty line and uses wood and biomass to fulfill their primary energy needs. The key drivers to develop renewable energy (RE) in developing countries are the poverty eradication, risk reduction and protection of the natural life systems. Poverty eradication will improve the other linked up factors too such as health, education, employment opportunities. One of the significant feature of RE is that the benefits are tripled down to the lower level i-e the rural and neglected communities.(Holm & Arch,2005)

Many academicians have identified renewables potential role of meeting the MDG's. .MDG's are the specific goals outlined to achieve by the year 2015. According to the task force report, though there is no direct MDG related to energy but renewable can indirectly play an effective role. (Konrad-Adenauer-Stiftung and East West Institute, 2007)

One of the major goals is the alleviation of poverty. RE can do it by decreasing the household expenditure of cooking, lighting and heating. It can generate employment opportunities for man as well as women. Electricity provision can extend the working hours; moreover the productivity can be increased by powering the machinery.

Access to primary education could also be increased by deploying RE. It will provide light for the studies beyond day time. It will provide better services clean water, sanitation, heating cooling systems which will decrease the drop out rates in schools.

For instance Swaziland under UNESCO started a solar program, for rural electrification. Under the program full community was involved in maintenance of the project. The project electrified the classrooms in the area and provided electric audio/video facilities in schools. More over under the project teacher homes were electrified too, and a 1.35 dollars per month fee was imposed on them. The fee was imposed for the maintenance of the project in the long run. (Flavin & Aeck, 2010)

RE's role can also not be compromised in advancing women's empowerment and gender equality. As use of RE can produce equal employment opportunities for men and women. Hence it can reduce the gender gap. For instance the installation of bio diesel plants in Mali has increased the women empowerment. Increasing their annual income from 40 to 100 US Dollars. Moreover freeing their six to eight hours which they could utilize in other productive activities for example they could improve their education, thus can also improve the literacy rate of women.

Renewable Energy also assists in improving the health conditions of the community by reducing the indoor pollution and improving the standards of health care. For instance eighteen rural clinics in Burma were installed with solar PV panels. These raised the

health care services of the clinic and played pivotal role in the survival of Karen refugees. These PV panels help the doctors to work during the night too and improved the checkup conditions in the rainy and cloudy weather. Similarly in El Mulato, a remote mountainous area in Cuba was electrified with PV panels, which improved the health of the people by using electrocardiographs and x-ray machines and also reduced the infant mortality rate (Flavin & Aeck, 2010)

Another significant MDG of environmental stability could also be achieved by RE usage. Since it reduces deforestation, GHG emissions, pollution will reduce climate change and global warming phenomena, thus progressing towards a sustainable environment.

Besides the above benefits and rationales to develop RE in the developing state. Another vital reason for the development of RE in the developing state is the energy shortages that are being faced in this part of the world. It has been observed that energy shortage is becoming a real bottle neck in development; therefore it is inevitable for the developing states to find alternate solutions to the problem. (UN, 2005)

Pakistan being a developing state is striving hard in its energy sector; presently the country is facing extreme challenges and crises in this regard, effecting country's social and economic development. According to the statistics, in the last 15 years country's primary consumption of energy has increased to almost 80 percent, from 34 million tones oil equivalent to 61 million tones oil equivalent. All this consumption is mainly based on conventional fuels (mainly oil and gas) (Pakistan Energy Outlook, 2012).

Pakistan internal oil production fulfills only one sixth of the total oil requirement while the rest is fulfilled by importing. It spends a major proportion of its budget on oil import. During financial year (2011-12), the country spent 14 billion dollars on oil import to meet

its energy demand out of its total budget of 43 billion dollars; this means that 32.5 percent of budget was allocated for the import of oil. The oil import bill during financial year 2008- 09 was 9.36 billion US Dollars respectively (Pakistan Economic Survey, 2011). Natural gas is also being used by the country but since it is depleting fast and no major drilling project has been undertaken by the country hence it is facing critical shortages in that area too. Besides potential coal reserves in Pakistan, coal has not been a major supply mix (Pakistan Economic Survey, 2011).

According to the statistics of Pakistan energy book (2010), the total oil import was allocated either to operate power houses or to transport sector. 61.5 percent of the total imported oil was consumed in transport sector while 23.5 percent of the imported oil was utilized in power houses during year 2004 – 05. However, during year 2009 – 10, almost 46.3 percent of the imported oil was allocated to transport sector, while 46.1 percent was consumed to run power houses. This reflects an almost 100 percent increase in the amount of oil used to run power houses. Thus on the basis of these figures, we can assume that almost half of total oil import bill goes directly in the operation of power houses. (Rehman, 2010)

Thus, with ever increasing energy demand on one hand and short comings, massive gap between demand and supply on the other, drives the country to think of a solution. There can be two options to the energy crises. One, either to increase supply according to demand which will keep on increasing rapidly called 'demand accommodation' strategy. Another option involves radical change in energy options, at the earliest possible opportunity. There must be a shift in the utilization of energy away from non-renewable sources, such as coal, oil, gas, towards increasing use of renewable, i.e. wind power, tidal

power, biogas, solar and geothermal energies. This shift has to be of an appropriate enormity that will take over of all the increases in future consumption from non-renewable sources. (Sheikh, 2010)

According to some academicians and policy makers, the best solution for Pakistan energy crises is Renewable Energy. Since Pakistan has abundant indigenous resources of wind solar, hydro and biomass because of its geographical location, but these resources have not been tapped to its fullest. Few steps were taken by the government in early 80's by doing some feasibility studies and later on by establishing some institutions for the promotion of renewable energy but none of the efforts were fructified since it lacked a concrete policy and its implementation framework. (Sheikh, 2010)

One of the major break through for Pakistan came when the first concrete step by the Government of Pakistan was taken in 2006, by forming its first ever renewable energy policy. It was comprehensively and specifically devised for the promotion of renewable energy power projects. The policy aimed to achieve energy security, economic benefits, social equity and environmental protection .The policy provided all the incentives to develop the particular sector. But the results of the policy couldn't be achieved except for few eliminatory projects. The second policy dedicated to ARE, was introduced in 2011.The policy expanded its areas and was much mature than the previous one, but the results of the other policy were also not up to the mark.

So the question here arises that besides the potential in the RE sector and critical need for the development of RE along with the policy intact why Pakistan has not achieved a major breakthrough in this area.

The answer to the question is that these policies have weaknesses; they lack the practical frame work for policy implementation. All the project development exists in paper work only and in practical terms they are almost non-existent. As these policies failed to attract private sector confidence and investment.(Mirza et all, 2009)

Thus the study will analyze Pakistan's energy sector, its structure, and the policies and will accentuate the various challenges associated with the energy sector. The study will also look at the possible solution for Pakistan's energy crises that is the development of RE in Pakistan. It will try to throw light on the RE potential, the steps taken by the government for RE, including the two policies released till now.

The study will further systematically analyze through the SWOT analysis, the various challenges and barriers that halt the efficient implementation of the RE policy.

Since these barriers are a real set back therefore the study will look at the various ways through which Pakistan can mitigate these challenges and barriers, and can lay the foundation of a vibrant and robust renewable energy sector.

1.1 Major concepts:

1.1.1 Fossil energy/non renewable energy:

Energy that is derived from hydrocarbons are known as fossil energy, non renewable or in other terms traditional or conventional energy. These are named as non renewable or fossil because the energy is obtained from the centuries old decay of plants and animals which are confined in the geological deposits. Oil, coal and natural gas are the three main energy sources that fall in this category. One of the characteristics of these fuels is that they are non renewable, takes centuries to form and cannot be replenished. Currently

fossil fuels are the significant source of energy. They are used not only at domestic level, but also at commercial and industrial levels. (Simon, 2007)

1.1.2 Renewable energy:

Renewable energy is that energy that is drawn from an inexhaustible source that is replenished continuously.

These sources include solar, wind, tidal, biomass and geo thermal. International energy agency (2003) explains renewable energy as

> "Energy derived from natural processes and that are replenished at a faster rate than they are consumed, are called renewable energy. Solar, wind, geothermal, hydro, and some forms of biomass are common sources of renewable energy."

1.1.3 Wind energy:

Wind energy is one of the oldest energy sources. Gathering of the energy from the wind is through a wind turbine that is the constant rotary motion of the propeller type blades that are connected to a mast. These turbines are used in the areas where the wind speed is greater and constant .High altitudes and off shores are perfect places for wind farms.

1.1.4 Geothermal energy:

Geothermal energy uses the heat of the earth to produce the energy. Since the earth mantle is composed of various superheated iron and other elements, and at some places these are very close to the earths crust and below the water layer hence it can be used easily for energy production.

1.1.5 Hydro energy:

Energy that is obtained from water in high elevations is called hydro energy. It can be obtained from building dams or from the tides / wave's power.

1.1.6 Solar energy:

Energy gathered from the sun is called solar energy. Two main technologies used for that purpose are photovoltaic and concentrated solar thermal systems. Photovoltaics are the cells that trap the solar energy and the concentrated solar thermal system, involves the use of various mirrors to focus and trap the heat in the central receiver.

1.1.7 Biomass energy:

Biomass refers to all the materials that are the product of living organisms. This includes the manures of animals, plants, agricultural wastes etc. These all are not used directly but are processed in a biogas plant and hence used as a renewable energy (Wengenmayor & Buhrke , 2013)

1.2 Objectives of the study:

The objectives of the study is to provide an insight of

- The importance of renewable energy for Pakistan and its significant role in overall energy equation
- Unleashing Pakistan's renewable energy potential and development keeping in view Pakistan's policy and
- To provide a critical analysis of the challenges and barriers in the implementation of RE policy and in the overall deployment of RE sector by giving a way forward.

1.3 Scope of the study:

Pakistan being a developing state is facing a lot of problems in its energy sector. In-order to overcome the difficulties, one of the steps taken by the state is to develop its RE sector by formulating an RE policy. The study aims to critically appraise Pakistan RE policy, focusing the various barriers (socio, political and economic) that are halting the efficient implementation of the policy.The study will also provide a way forward for the future. The scope of the study is limited in terms of technical aspect.

1.4 Research Questions:

- Why renewable energy for Pakistan rather than conventional energy?
- What role RE can play in Pakistan energy equation?
- To what extent Pakistan has taken steps to unleash the potential?
- What are the barriers in implementation of renewable energy in Pakistan?
- How the barriers can be overcome?
- What is Pakistan's future in the renewable energy development?
- How renewable energy can play a significant role in Pakistan energy equation?

1.5 Research Methodology:

The study taken will be descriptive and analytical with deductive and critical reasoning in an applied manner. The research methods for the study will be qualitative in nature with a key focus on content and SWOT analysis .The type of data will be mostly secondary in nature, which will be analyzed by the researcher.

1.6 Literature Review:

Energy has been a major driver in all the economic activities. It is not only considered as one of the keys for all the developments rather it has been recognized as the foundation of the state's welfare. Thus many scholars and acamadicians in their works have accentuated the importance of energy for a state and have made an effort to echo this significance at all levels. But lately a lot of noises have been made regarding the availability and sustainability of fossil energy and has augmented the concept of Renewable energy and its various benefits.

Christopher A Simon(2007) in his book has laid out the importance of energy in a very effective manner. He supports the view that energy is not only the food for welfare and all the developments of a state rather it is the key to shape a state's future. He well spotted that since energy structure of the world has changed over the period of time from fire to oil/gas era hence resultantly energy consumption has also amplified .This consumption on one hand has an outcome in the form of massive productivity and boost of development and on the other hand has given rise to various issues. Christopher has questioned these issues in the form of future availability of energy resources, unpredictable international conflicts, emergence of concept of energy independence and most importantly the broad range of issues that fall under the category of "environment." Christopher not only draws attention to these issues but has put them as a pretext to look and develop for the "alternative" that is the alternative or renewable energy. Christopher's view has been supported by Paul Komor (2004) in his book "Renewable Energy Policy." Paul like Christopher has categorized the problems of the fossil energy system but unlike Christopher his main argument was environmental issues. He sights

environmental damage as one of the foundations to develop renewable energy. He writes that RE has low damage to environment. It is a non depletable or sustainable resource with an additional advantage that it is widely distributed unlike fossil energy. Paul has pointed that though the initial cost of the RE is greater than other, along with the fact that RE resources are ubiquitous and intermittent but still the long term benefits are much greater than all these costs.

Thus these various questions raised on the fossil energy give rise to a new debate of renewable energy which is seen as sustainable and a viable option because of the various benefits attached to it.

Economic benefits is one of the keys to develop RE .The US department of Energy (1997) in their report has discussed two key economic benefits that RE can produce .One RE is labor intensive (hence creating jobs direct, indirect and induced) second since indigenous resources are used which means energy dollars are kept at home. Other spill over benefits of using RE are research and development, increased security and reliability and tourism potential. On the other hand, Christopher Flawin and Molley Huck (2007) keeping in view the economic benefits of RE has looked at the concept in achieving the MDG's. In their paper "Energy for Development: Role of Renewables" has highlighted the role of renewable energy in achieving the MDG's. They have discussed that RE has not only benefits related to environment and efficiency rather they have a potential role to meet the MDG's.Though there is no direct MDG related to energy but they have discussed that since RE investments are mostly dependent on materials and workmanship, consequently creating jobs and strengthening local economies therefore can play a momentous role in

poverty reduction and human development and thus can be engaged in achieving the MDG's.

These benefits will be spilled over to social development and benefits too by retaining the rural population producing stability, community pride, increasing individual skills and knowledge and also improving health and education sectors.

Zachary A Smith and Katrina D Taylor (2008) in their book "Renewable and Alternate Energy Resources" have discussed the various benefits that are generated by RE. One of the themes of their book remained the various environmental benefits one can draw by implementing RE .They have discussed that RE not only reduces carbon emissions but also creates new environment for the rare species, use of the RE can be helpful in reducing the risks of flood and will be helpful in providing clean air and in reducing the landfills.

So keeping in view the various economic benefits of RE, many scholars and acamadicians have tried to put the developing states in that larger picture of energy. Scholars are of the view that RE is not only a viable option for the developed states for their sustainable growth but RE can have a key role in the developing states.

Deitor Holm and D Arch (2005) in their paper "Renewable energy future for the developing world" have discussed some precursors that why RE is important for the developing states. They are of the view that poverty eradication, risk avoidance and protecting the natural life support systems are the foremost reasons for the development of RE in developing states. Holm;s and Arch's view has been supported by Dr Peter Koppinger (2007) in the conference report named as "Renewable energy: potential and benefits for developing countries" .He has discussed that poverty eradication is the main

driver for RE development. This goal has spillover benefits like improvement in education, health facilities, economic development and welfare.

A country like Pakistan, which is a developing state, is struggling hard in its energy sector. With a population of more than 170 million people and a total consumption of more than 61 TOE, the country is facing extreme shortages in the energy sector with the biggest challenge of continuous increase in demand .Many scholars believe that Pakistan is in a desperate need to look for alternative. One of the alternative is to develop its RE to tackle the various energy problems .They have agreed to the point that RE can show a brighter future for Pakistan.

Bilal and Attique (2010) in their paper "The face of Renewable Energy in Pakistan" has discussed Pakistan distorted energy sector and has discussed the various causes of its distortion making a background to develop RE in the country. They states that If we look at the energy sector of Pakistan, we will realize that Pakistan is highly dependent on the conventional fuels that are oil, gas and coal .Pakistan is a state which is blessed with conventional resources mainly gas and coal but they are limited, gas reserves are there and contributes 51.6 percent in the total energy supply while coal contributes only 6.2 percent. Pakistan internal oil production is limited and meets's only 1/6th of the total energy demand which is very minimal hence the rest is imported from other countries putting a lot of pressure on the economy. Moreover because of the upheavaled economy Pakistan has not undertaken any major or big exploitation within the country. With the increasing demand in the energy and limited supply, the country went into extreme energy shortages Bilal and Attique has also accentuated some other reasons for the Pakistan imbalanced energy equation. They see that besides ineptitude ness of the

exploration sector, misallocation of the resources and funds, continuous increase in the oil prices along with power wastage and lack of planning are also responsible for the Pakistan distorted energy picture.

Bilal and Attique view has been supported by Elizabeth Millers (2012) in her paper "Pakistan Energy Crises". She has also accentuated the reasons for Pakistan imbalanced energy equation. She is of the view that circular debts and lack of investment in the energy sector are one of the reasons but unlike Bilal and Attique, Miller has highlighted some other pivotal issues which are contributing in energy crises. According to Millers reform and governance issues, cultural change along with security and federal provincial tensions acts as fuels in the crises making the efforts unproductive.

So keeping in view Pakistan's energy situation and massive increase in demand by every passing day ,there is a need to develop its RE .Many scholars believe that Pakistan has a lot of potential of RE ,the need is to un tap it.

Dr Muhammad Shahid Khalil (2010) in his paper "Renewable energy in Pakistan: status and trends" has discussed not only Pakistan's potential in RE. but has also highlighted its benefits too Highlighting Pakistan's solar energy potential, he states that, Pakistan is situated in the sunshine belt with long shinning hours (almost 8 to 8.5 hrs) one of the highest in the world and has high insulation levels thus is ideal for installing solar technologies. Moreover geographically Sindh and Balochistan are ideal for these installations it will not only advance socio economic development but will also play critical role in the energy equation. Abdul Waheed Bhutto and others (2012) in their work has also highlighted Pakistan solar potential. Their view is in line with Dr Shahid Khalil. They suggest that Pakistan needs to untap its solar potential and makes its development a

priority. Discussing Pakistan wind energy potential, Irfan Afzal Mirza and others (2012) in their paper has stated that Pakistan coastal belt has been blessed with natural wind corridor, (especially Gharo Keti Bandar Area) with a potential of producing fifty thousand mega watt of electricity. Studies have been undertaken by the Pakistan Metrological Department and National Renewable Energy Laboratories USA and all the studies have confirmed the strong potential for wind energy production in these areas. Along with Sindh, Northern areas and Balochistan are also being identified for producing potential wind energy. In terms of hydro and biogas energy, Zafar Iqbal (2012) states that Pakistan has abundant and manageable water that can be utilized in hydro energy .While in terms of biogass, the country is not only agrarian but also possess more than forty eight million of animals, whose dung can be utilized for producing bigass energy that can be used for various purposes. Ahmed and Rashid (2010) have overviewed Pakistan potential of geothermal energy. According to them geothermal energy is one of the cleanest and most suitable RE and Pakistan has enough resources and potential to exploit it They states that Pakistan has a seismic belt passing through the northern areas and have almost 6000 identified surfaces which have the potential of producing geothermal energy, the only need is to invest and utilize .

Seeing Pakistan high RE potential Munawar A Sheikh (2010) sights that developing RE in Pakistan is a viable option; it will not help only in balancing Pakistan's energy equation by reducing oil imports, improving the economic development, but will also improve energy security and will facilitate environment friendly state.

Throwing a light on Pakistan's efforts in developing RE Mashal Yazdanie (2010) in her paper "RE in Pakistan: policy strengths, challenges and way forward" states that one of

the biggest step towards RE was developing a policy in 2006, even before that some preliminary steps were taken by forming Alternate energy board and some other institutions like Pakistan Council of Renewable Energy Technology. These institutions were designed to promote the RE in the country .Discussing the policy of the country she states that policy (aimed to promote wind, solar and small hydro projects) and objectives are to promote energy security, economic development, social equity and environmental protection, it is aimed to be done by promoting the RE in the country, make it in the total energy supply, promote private investment and to give lots of incentives for that purpose. For this purpose several initiatives were taken, private investors were encouraged to put forward proposals for all IPP, captive power and standalone projects, for non IPP projects letter of intent, letter of support and implementation agreement with the government are not required no tax are imposed on equipment, including no income tax, with and special care has been taken by introducing net metering and billing. Later this policy was replaced by a midterm policy of 2011.

Though it is true that Pakistan has a strong potential of RE moreover it has a policy intact too but still significant results of its development cannot be measured .Pakistan is facing a lot of issues and challenges in the implementation phase. These barriers are a set back for Pakistan.

Meyers and UNFCC has categorized the barriers of adoption of renewable energy policies for any state into seven main categories. Institutional, political, technological, economic, information, financial, cultural and general. Both of them has written that these are the general barriers and the intensity of these barriers may vary from state to state. For some states institutional barriers may be more important and for some

economic or political barriers, so it all depends on the state composition. On the other hand Anthony Derek (2009) in his paper has discussed institutional barriers for the RE, he thinks them as greatest as far as RE is concerned, Derek states that since RE is not genuinely considered in the countries as an option hence all the institutional barriers starts springing up. Catherine and others (2010) identifies that the challenges for RE implementation mainly arises when the policy is in conflict with existing regulation, or there is lack of institutional capacity or skilled workers. Moreover fiscal restraints can have a critical role in implementation of RE.

With respect to Pakistan ,Mirza and others (2009) has identified key policy challenges and barriers in the RE ,that can be put into two broad categories .First economic/financial barriers and non economic /non financial barriers .the first category includes the lack of finances, market barriers and other economic issues while the second one which they sees far more important are institutional barriers, poor infrastructure, poor information and technology access, lack of capacity and training ,lack of social awareness and acceptance ,which are a major hindrance in policy implementation. Mashal Yazdanie (2010) in her paper too has identified the same sort some of categories of barriers and has discussed them and have also given some recommendations On the other hand Tahawar Hussain (2012) sights that one of the major hindrance in implementation of RE in Pakistan is the lack of integration, planning and implementation mechanism, there is a lot of duplication of efforts which rather in solving the issues, messed up the hindrances.

1.7 Theoretical framework:

Ever since the term "sustainable development" is coined energy has been seen as an important aspect of it. Many authors are of the view that energy plays a vital role in a state development. This development is not restricted only to the economics rather social development and welfare and improved living standards are pivotal in this broader context of development. Initially non renewable or fossil energy was dominant in this debate. But with the passage of time several questions have been raised on fossil energy in the form of various environmental issues, challenges related to its future availability in the context of various unpredictable international conflicts .These all issues has formed a basis to look for alternative/renewable energy and converge it in the state's energy equation. Hence the debate of renewable energy has been added in the sustainable development concept, and this drives a state to form policies for RE and implement it to develop the present and secure the future. (Sathaye et all, 2010)

RE development is not only on the priority list of the developed states rather lately developing states have shown keen interest in the RE sector. Hence for that purpose policies have been formulated and efforts have been made to implement it. But implementing RE policies is a highly challenging task it requires a lot of effort and dedication from the various actors (economic agents, financial agents, public authorities, government organization). The challenges are even grave in the developing countries like Pakistan, who's RE policy is quiet nascent. And the crucial aspects of finances, the perceptions of the investors in the RE sector, the various interaction between the actors in various contexts all determine the success of the policy. (Konrad-Adenauer-Stiftung and EastWest Institute,2007)

In order to view all these issues a number of Public policy theories have been designed to critically analyze the policies and to accentuate the various barriers that can lead to inadequate policy success and overcoming those barriers can lead to successful policies. One of the theories through which we can see the RE policy is **"Contextual Interaction Theory"** developed by Hens Bressers. The theory provides a systematic framework for identification and addressing of factors that can affect the policy implementation process. The theory assumes that policy implementation process is an actor interaction processes. These interactions are a dynamic and social process which determine either the adequate policy implementation or inadequate. These depend upon the actor's:

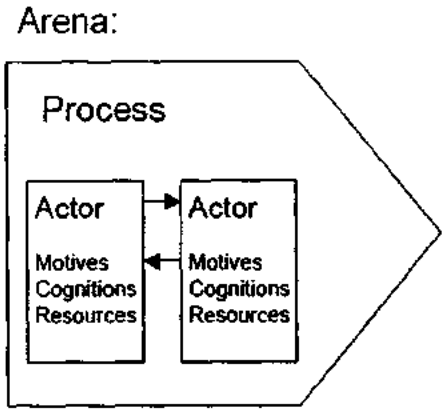
1.7.1 Motivations: to what extent the policy is significant for the actors and to which degree they contribute to their own goals and objectives. Low motivation can push the actors to ignore the implementation or can lead to implement it half heartedly

1.7.2 Information/cognitions: means that the actors must hold all the relevant information, not only the technical information rather they should also identify their pattern of communication between other actors and the target groups.

1.7.3 Resources (capacity and power): means that to what extent the actors have been given authority and have the capacity to implement the policy.(Bressers, 2007)

The above three characteristics shape the interactions of the actors in the policy arena

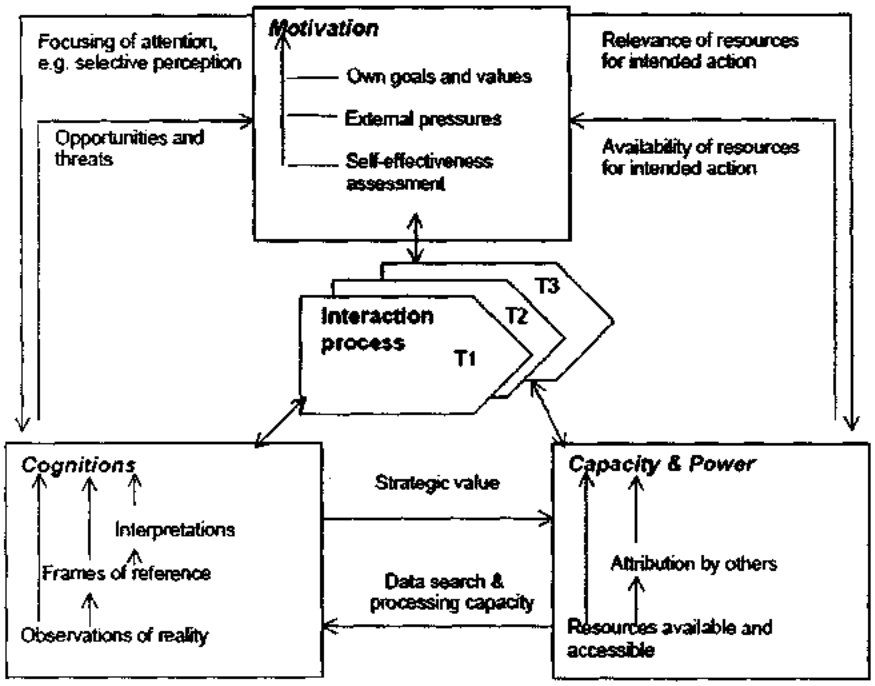
Figure 1: Simple policy arena



Source:Hens Berssers article on CI theory

The policy arena is even more complexed when looked at it deeply

Figure 2: Dynamic interaction between the key actor characteristics



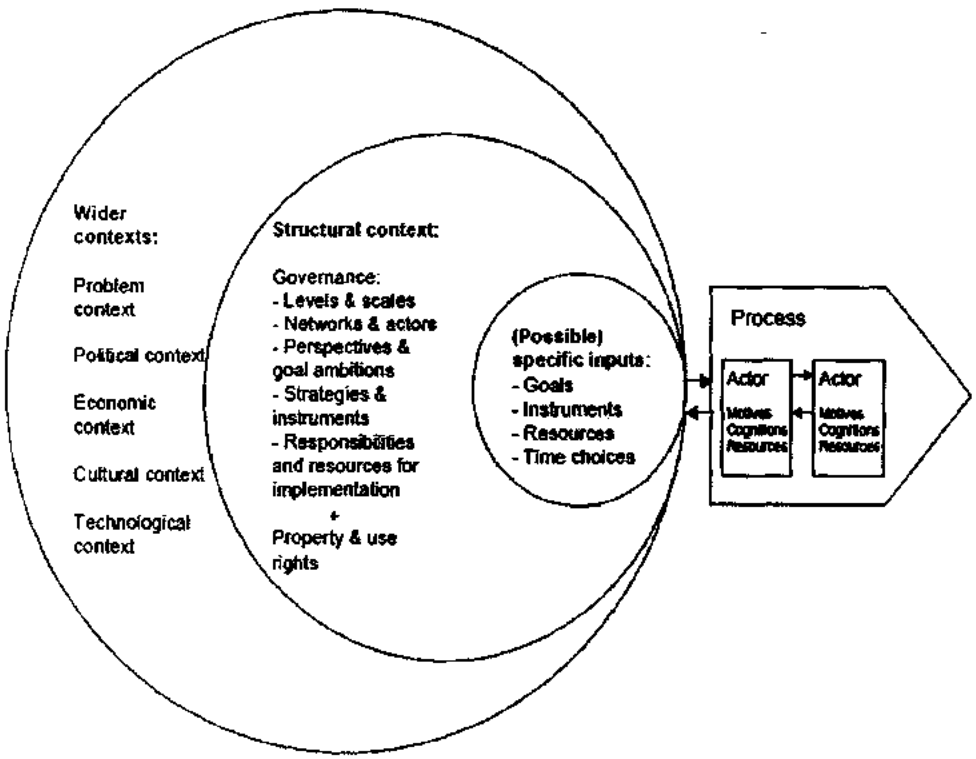
Source: Hens Bressers article on CI Theory

The above figure shows a dynamic interaction between the key actor characteristics that drive social interaction process and in turn are reshaped by the process

But these are not the only characteristics that effect the policy implementation. They are further influenced by the structural context (governance, perspective and goal ambitions, strategies and instruments, property and use rights) which is further affected by wider contexts like political context, economic, cultural and technological contexts (Bressers, 2007).

The below figure shows the layers of context that plays a significant role in policy implementation process.

Figure 3: Layers of context in policy implementation



Source: Hens Bressers article on CI Theory

The contextual interaction theory primarily identifies seven key dimensions that should be taken into account while analyzing any policy i-e that can effect the policy implementation in any respect

- The policy (content), its formulation and dissemination
- Social, political, economic context
- Leadership for policy implementation
- Stakeholder involvement in policy implementation
- Implementation, planning and resource mobilization
- Operations and services
- Feedback on progress and results (Bressers, 2012)

Taking into consideration Pakistan's RE policy, it can be better looked through the of contextual interaction theory, since Pakistan's RE policy is nascent and Pakistan being a developing state is facing lot of barriers, and these barriers can be better identified using the above mentioned theory.

1.8 Limitations:

The research has been limited in terms of the technical aspect of the policy. It is also limited in terms of time availability and access to the primary sources.

Chapter Two

Energy Scenario of Pakistan

Affordable, sufficient and secure energy availability is considered as a pre requisite for the human development in the current era. Thus energy conservation, energy security and sustainable development have become the key notions in the state's priority list. According to the World Resource Institute (2013), globally the energy consumption has increased up to seventy percent since 1970's.The key fueling factors behind it are: economic expansion and development.

Pakistan being a developing state is striving hard in its energy sector. States up-heavaled economy coupled with a population growth rate of 1.8 percent per annum has posed serious challenges for the supply demand energy equation. (Index Mundi, 2013)

This chapter briefly discusses the energy scenario of Pakistan. It will throw light on the over all energy equation of Pakistan, the various energy sector institutions along with the energy policies till date. The chapter will also explain the various challenges being faced in the energy sector, along with accentuating the solutions for the problem.

2.1 Over view of current energy equation:

Pakistan is an energy deficit country since beginning. Historically even before independence, because of the energy issues, there were several questions that were raised on the country's economic perspectives.

The country went under severe energy challenges in the late 80's, where almost all the cities went under power outages to save the energy. According to the reports only two

third energy requirements were met through domestic resources till 1980's, which was far less. On the contrary, 1990's era was considerable better for the country not only in terms of energy availability but also in terms of economic development. But still the energy institutions were faced with multiple challenges and were engaged in bridging the gap between a large demand and a limited supply (Miyan & Nayyer, 2009).

With the dawn of the twenty first century, the energy challenges become double fold with in the country. One of the dominant constraints that remained in the previous decades too was the increased demand and limited supply. According to the various statistics, there has been an eighty percent increase in the energy consumption in the twenty first century. In the year 1995/96 the consumption was thirty four million tons oil equivalent (TOEs) which has crossed sixty one million TOEs in the year 2011/12.

The energy equation became more complicated because of the natural disasters, which struck the country from time to time in the twenty first century. There natural disasters caused great damages to the transmission lines. According to the ADB report (2011) "2011 Pakistan Floods; Preliminary Damage and Needs Assessment", the floods in Pakistan caused 1.2 Billion Dollars damage to the transmission lines. On the other hand the continuous variation in the oil prices, and the problem of low capacity refineries, coupled with shortages in the gas sector (lack of exploration, depletion of the resources and law and order situation), created a great pressure on the energy sector (Pakistan energy outlook, 2011)

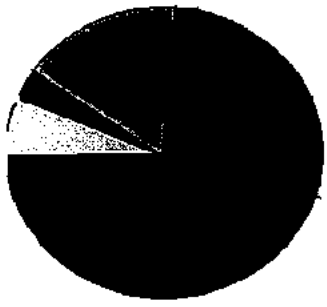
Since the measures were inadequate to meet these huge energy challenges, making it difficult for the governments to cope up with these energy obscurities. Another huge problem with Pakistan energy sector, which is significant, is its high reliance on the fossil

fuels. Looking at Pakistan energy mix, we will see that there are three prime energy sources which make up the whole energy equation.

- Oil
- Natural gas
- Hydel

Pakistan being a developing state is highly reliant on oil and gas. These two most dominant sources constitute almost seventy percent of the total energy mix. Coal, nuclear also adds in the energy supplies but their contribution is quiet low almost 7 and 2 percent respectively. Though the country is rich with natural resources like gas (larger consumer in the region) and coal (sixth largest reserves in the world) still the state has not tapped these resources to its fullest. (Pakistan Economic survey, 2013)

Figure 4: Share of sources in Energy Equation



Gas: 40 Percent **Oil: 30 Percent** **LPG: 1 Percent**

Hydel: 19 percent **Coal: 7 Percent** **Nuclear: 2 Percent**

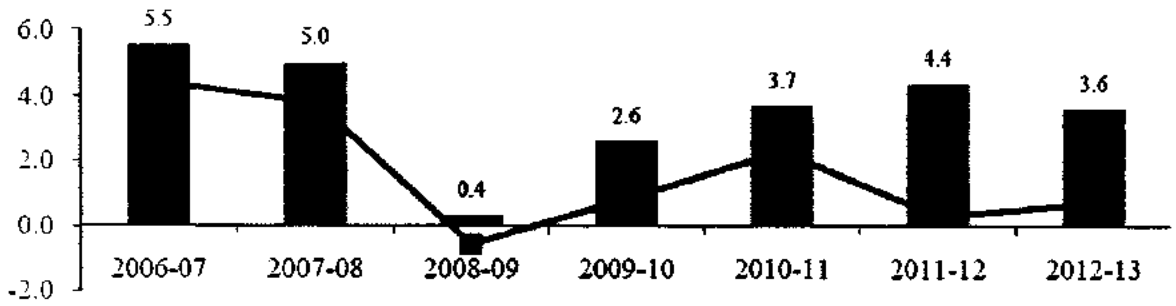
Source: Hydrocarbon Development Institute of Pakistan 2012

Above is shown diagrammatically the energy sources that are fulfilling the country's primary energy demands.

Analyzing the FY 2012, it is concluded that the supply of the energy was 64,727 TOE's as compared to the supply of 644,522 TOE's in the FY 2011.Hence a growth of 0.32 was observed. (Pakistan Economic Survey, 2013)

Since energy consumption and GDP growth are highly correlated, and a state's development relies on it, therefore Pakistan needs to put the efforts to overcome the crises to prosper in a true manner. Graphically Pakistan's correlation between GDP and energy consumption can be shown as follows

Figure 5: Correlation between Pakistan Energy Consumption and GDP



Source: Pakistan Economic Survey 2012-2013

Above is observed that, where the energy consumption is increased the GDP is high too. And where it is low, GDP is low too.

Below is listed all the natural resources which makes up Pakistan's primary energy mix.

2.1.1 Petroleum products (Oil):

Oil plays one of the significant roles in Pakistan energy mix. With the potential resource of twenty seven million barrels. It has the capacity to produce only 66,032 barrels per day, which fulfills only one sixth of the total energy demand. The increase demand of the oil has pushed the government to import a large quantity almost double of which it is

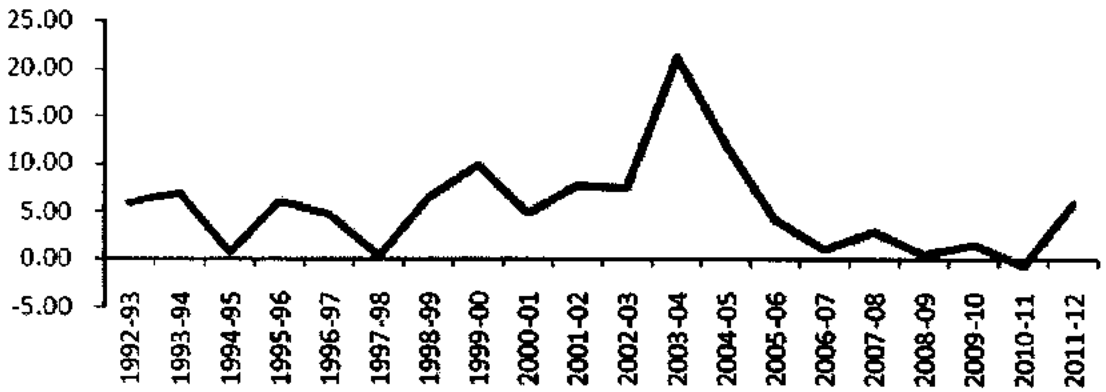
produced .Only in the fiscal year 2012, 47,104 barrels of crude oil was imported to meet the energy demands. Similarly net petroleum that was produced locally was 8395 while 11507 were imported. So the import bill for the fiscal year 2012 became 10.292 million US Dollars. The import bill has increased 27 percent since the year 2003. Only in the year 2011 the oil bill was twelve billion US dollars while on the other hand in the year 2012 only the petroleum group bill summed up to 15.2 billion US dollars. Thus this increased import of oil put severe constraints on Pakistan's economy. (GoP, 2013)

2.1.2 Natural Gas:

Natural gas is considered to be cheaper in meeting the domestic demands as compared to the expensive imported oil. Pakistan being the largest consumers of the natural gas has potential reserves of about 282 trillion cubic feet. Total recoverable reserves are of twenty four trillion cubic feet. And per day extraction of the gas in the fiscal year 2012 was four billion cubic feet. While a growth of 4.5 was seen in TOE.

The growth in gas supply can be shown graphically as

Figure 6: Growth in Gas Supply



Source: Hydrocarbon Development institute of Pakistan

Pakistan is facing intricate challenges, because of the misallocation and low growth of the gas sector (Pakistan petroleum limited, 2012). According to the Economic survey of Pakistan (2012), the country is facing gas shortages of 2 billion cubic feet per day.

State Bank of Pakistan (2012) has given three primary reasons for gas shortages in Pakistan. According to their report the gas shortages in Pakistan is because of the following reasons:

- Depletion of the resources.
- Lack of new exploration and extraction of the gas projects.
- Uncertain and unpredictable security situation in the country.

Only in the current fiscal year (FY 2013), the period from March to July the gas supplies reduced to about 2.2 percent from the FY 2012, which is from 1,164,915 (FY 12) to 1,139,253 (FY 13) respectively.(GoP,2012)

2.1.3 Compressed Natural Gas (CNG):

Since the last decade, Pakistan CNG industry has seen a tremendous growth, making Pakistan one of the leading countries in the world with NGV's almost 2.7 million. CNG is not only environmental friendly rather it is much cheaper than other options. But over the past few years due to mismanagement coupled with other problems, the CNG industry has seen some severe set backs (Raza, 2010). The problem is so severe that recently in (winters,2013) it has been suggested to shut down the CNG for vehicles for three months, in order to make sure an uninterrupted supply of natural gas for the house hold services (The Nation, 2013)

2.1.4 Liquefied Natural Gas (LNG):

In order to facilitate the use of LNG, the government of Pakistan has approved the LNG policy 2011.Under these guidelines the country has undertaken two fast track LNG projects for the LNG imports to make it a significant part of the total energy mix. Pakistan has plans to start importing LNG from Qatar and the process is underway (The News, 2013).

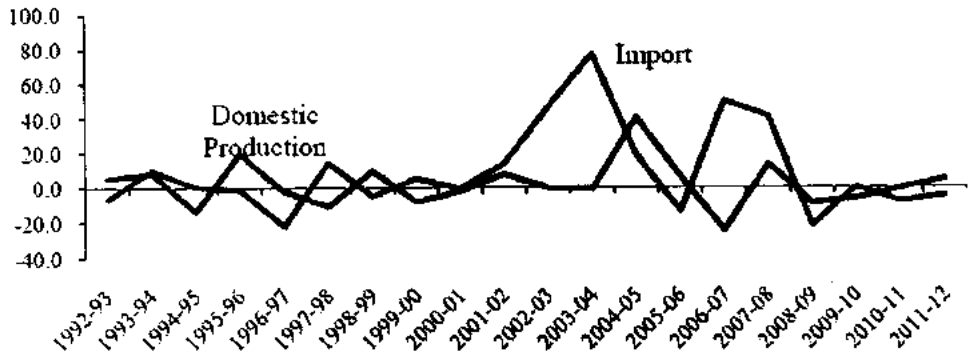
2.1.5 Liquefied Petroleum Gas (LPG):

LPG is another environment friendly and inflammable mixture of hydrocarbons. In Pakistan LPG contributes to about one percent in the total energy mix, but efforts are being made to increase the supply. For this purpose the government of Pakistan approved LPG guidelines 2013 to increase the LPG imports in order to make an increase in the use of LPG. (Fueling Pakistan, 2013)

2.1.6 Coal:

Pakistan is a coal rich country. Its total proven coal reserves are 186 billion tones. Out of 186 billion tons, 175 billion tons are only identified only at Thar coal fields. But besides being rich in coal Pakistan imports coal to meet its domestic demands. According to the energy book (2012), Pakistan imported coal 2.84 mt to 4.27 mt from 2006 to 2011 respectively. The main reason to import coal is that the domestic coal is low in BTU and cost is much higher if it is processed for usage (Malakani, 2012). The growth of coal supply over the years can be shown graphically below. It can be seen that the domestic production is quite low as compared to the imported coal.

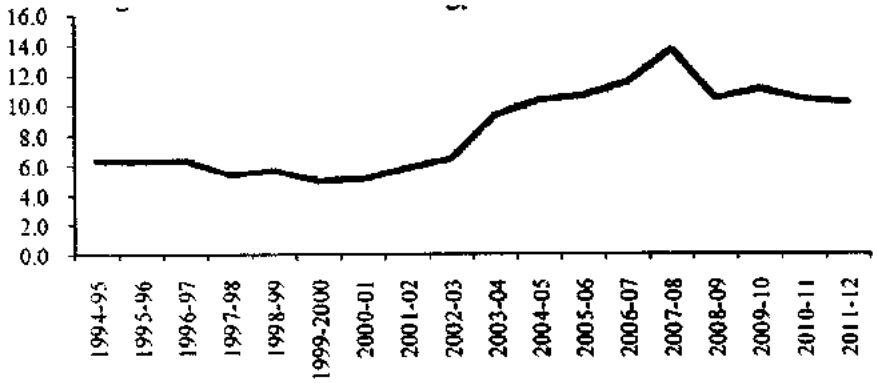
Figure 7: Growth of coal over the years



Source: Hydrocarbon Development Institute of Pakistan

The total share of coal yearly in the energy sector can be seen as follows

Figure 8: Share of coal in the energy sector



Source: Hydrocarbon Development Institute of Pakistan

A major breakthrough for the country has come up recently with the launch of Thar Coal Power Project launched in January 2014.the 1.6 Billion US dollar is a joint venture between Engro powergen and Government of Sindh. The first phase of the project will be able to produce 660 MW of energy. While at the end of the project Thar will be contributing about 2400 to 3600 MW of energy in the total energy mix.

Moreover six other sites (Qadirabad, Bhiki, Haveli, Bahadur Shah, Balloki,Taranda Sawaiwala and Mouza Karam dad Qureishi) have also been identified for starting up

coal based projects in Punjab. It has been planned to run these plants on imported coal for a short term and then later local coal will be used (Dawn, 2014).

2.1.7 Nuclear:

Currently Pakistan has three operational nuclear plants, which constitutes about 2.4 percent in the total energy mix. One is operational in Karachi, KANUPP I, while the two are operational in Chashma I, Chashma II. While work on Chashma III and Chashma IV is under way. On the other hand work on KANUPP II and KANUPP III is withheld because of the financial constraints (Dalton, 2011).

2.1.8 Hydel:

Another important resource through which Pakistan gets energy is the hydel. Besides a huge potential, hydel constitutes only about 19 percent in the total energy mix. The major challenge in the hydel sector is that, the country is highly reliant on the old projects. The old projects capacities are declining because of the sedimentation. It is reported that at least 20 percent capacity of three reservoirs have been reduced and it is decreasing continuously. In the last forty years Pakistan has not undertaken any major hydro project except Ghazi Barotha project.

Currently Pakistan is operating twenty hydel projects in various parts .Five big hydel projects are at Mangla, Tarbela, Chashma, Ghazi Barotha and at Warsak. While fifteen small and medium sized projects are also operational. Some of the projects are under contruction, for instance Neelum Jhelum Hydro Power project (supposed to be completed in 2016). The GoP has also inaugurated the New Bong Escape Project under CDM in

March 2013 .The project adds up a 84 mw to the total mix (ADB, 2013). Along with these, few feasibility studies have also been completed.

Though Pakistan has a very high hydel potential but it has not un-tap the potential to its fullest .The clock is ticking, the need of the hour is to start up new projects and maximize the hydel energy part in the total energy mix. (Bhutto et all, 2012)

2.2 Organizational structure of the energy sector:

Pakistan energy sector primarily encompasses the following institutions.

2.2.3 Ministry of Water and Power:

Ministry of water and power is the executive limb of the government of Pakistan. As per schedule II, rule 3 (3) of the rule of business 1973, the major responsibility of the ministry constitutes:

- Supervision of all the matters related to energy generation, transmission and distribution.
- Supervision of the prices/policy: The institute through its various subordinate bodies and wings (administration, power wing, water wing and WAPDA) also supervises the matters related to pricing and policy making.
- Coordination: coordination with in the various wings of the ministry, along within the provinces comes under the sphere of the ministry.

Along with the above mentioned responsibilities, the ministry also plays a pivotal role in the various national activities in the areas of electric utilities, independent power projects

and special power studies. Maintenance of technical standards is also the chief responsibility of the ministry (Ministry of water and power, 2013).

2.2.4 Ministry of Petroleum and Natural Resources:

Another important institute in Pakistan's energy sector is the Ministry of Petroleum and Natural Resources. The division was established in the year 1977 under the fuel, power and natural resources ministry. Later on the division was given the status of the ministry. The sole responsibility of the ministry is to ensure constant supply of oil and gas for sustainable economic development. There are three core functions that are entrusted to the ministry i-e

- All oil and gas policy matters and legislation.
- The responsibility of the geological surveys.
- Lastly all the administrative matters related to oil and gas. (Ministry of petroleum & natural resources , 2013)

2.2.5 Hydrocarbon Development Institute of Pakistan:

HDIP is an autonomous body established under the ministry of petroleum and natural gas in the year 2006.The prime function of the institute is to promote sustainable energy development by endorsing R&D in the field of hydrocarbons and other related fields (HDIP, 2013)

2.2.6 National Electric Power Regulatory Authority:

In the year 1992, the government of Pakistan approved WAPDA's strategic plan for privatization of the power sector. The decision was made to meet three comprehensive goals.

- Capital formation enhancement.
- Rationalization of prices and perking up the efficiency
- Generating a competition by pushing private sector in a greater role.

In order to meet the above goals, it was essential to establish a regulatory authority that could administer the restructuring process along with the regulation of monopolistic services.

Creation of the regulatory authority was a pre requisite for the stability of the power/energy sector. Moreover a regulatory authority would also reduce the risk factor for the foreign investors. Thus keeping in view the above advantages associated with the establishment of a regulatory authority, the Government of Pakistan, under a parliamentary act (Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997), established a national electric power regulatory authority (NEPRA).

NEPRA has a major responsibility of the issuance of the licenses and determination of the prices for generation, transmission and distribution. Another major function is standards enforcement and quality insurance. The responsibility of approving and disapproving of the power acquisition and investment programs of the various utility companies also fall under NEPRA.One of the biggest challenges for NEPRA is to preserve its impartiality and objectivity. To overcome this challenge NEPRA has taken the step to make public all the lisences, making a public property that it issues. (NEPRA, 2013)

2.2.7 Oil and Gas Regulatory Authority:

OGRA has been established in the year 2002, under the OGRA act of 2002. The sole purpose to establish a separate oil and gas regulatory authority was to make the environment conducive for the private investment and to ensure a competitive and efficient regulation in the petroleum sector. Soon after its establishment, NGRA was subsumed under it, to promote cooperation and coordination between oil and gas sector (OGRA, 2013)

2.2.8 Alternative Energy Development Board:

AEDB whose establishment came through a parliamentary act (ACT NO. XIV OF 2010) serves as a self governing body for all the RE activities in the country. The main functions of the institute includes the formulation of the RE policies and to implement in a manner to achieve the desired targets set by the government. It acts as a "one window facilitator" for all the RE projects processing. Other function includes the coordination, evaluation and interaction for the RE generation. (AEDB, 2013)

2.2.9 Private Power Infrastructure Board:

PPIB was established in the year 1994 to open up the privatization in the Pakistani energy sector. It chiefly facilitates all the private investors in setting up the private energy projects. Thus acts as a one window facility. With the presentation from all the provinces it facilitates the inter provincial coordination. The board has also directives to strengthen the public-private relationship in the energy sector. (PPIB, 2013)

2.2.10 Energy Wing - Energy and Development Wing:

Under the Ministry of Planning and Development, energy wing was created in the year 1998.Its main function is to appraise all the transmission, distribution and generation projects submitted by WAPDA and KESC. It also takes part in preparing various energy sector programs (PPIB, 2013)

2.2.11 Power Utilities:

Power utilities in Pakistan constitutes of two vertically integrated institutions that are responsible for the state's power distribution and transmission.

- WAPDA
- KESC.

WAPDA was established by a statute in 1958 and was assigned with a central responsibility of power generation, transmission and distribution. With the largest generation capacity of almost 54 percent in the country the institution provides power to almost 88 percent of the total population. Hence making it one of the biggest power generation authorities In order to restructure Pakistan's energy sector WAPDA in 2007 was split into two, WAPDA and PEPCO. The former is entrusted only with the responsibility of water and hydro power development while the latter is liable for the fourteen public limited companies. Nine distribution companies, serving Islamabad, Multan, Lahore, Gujranwala, Faisalabad, Peshawar, Hyderabad, Quetta, and Tribal Areas.

- LESCO: Lahore Electric Supply Company
- GEPCO : Gujranwala Electric Power Company
- FESCO : Faisalabad Electric Supply Company

- IESCO :-Islamabad Electric Supply Company
- MEPCO: Multan Electric Power Company
- PESCO : Peshawar Electric Power Company
- HESCO : Hyderabad Electric Supply Company
- QESCO : Quetta Electric Supply Company
- TESCO : Tribal Electric Supply Company

While the metropolitan city Karachi is separately served by a private company KESC (Karachi Electric Supply Company).Under the Indian Act of 1882, the company was established in the year 1913.Under the electricity act of 1910 as amended and NEPRA act 1997, it is entrusted with the responsibility of power generation, distribution and transmission to the city of Karachi.

Along with these, three generation companies also play a vital part in the state's energy sector. These GENCO's serve southern, northern, and central parts.

- Southern Generation Power Company Limited (GENCO-1)

  Headquarters: Jamshoro, District Dadu, Sindh
- Central Power Generation Company Limited (GENCO-2)

  Headquarters: Guddu, District Jacobabad, Sindh
- Northern Power Generation Company Limited (GENCO-3)

  Headquarters: WAPDA House, Lahore, Punjab

On the other hand power transmission and dispatch is controlled by National Transmission and Dispatch Company (NTDC), which was established in the year 1998.The company, has a right and property over all the grid and transmission lines of 220 KV and 500 KV that is owned by WAPDA (WAPDA,2013)

2.2.12 Pakistan Atomic Energy Commission (PAEC):

Nuclear energy of Pakistan is obtained through three operational nuclear power plants which operate under the supervision of Pakistan Atomic Energy Commission (PAEC).PAEC is responsible for planning, construction and supervision of all matters related to atomic energy. One of the plants is installed in Karachi, which is called KANUPP, while the other two are at Chashma, and is called CHASNUPP I and CHASNUPP II.The construction of CHASHNUPP III and CHASHNUPP IV is underway and is expected to be completed in 2016 and 2017 respectively. Preliminary works of KANUPP II and KANUPP III was also started but was forces to be held in 2009 due to the financial constraints. But later in 2013 they have resumed their work in order to add up in the energy mix (PAEC, 2013)

2.2.13 Energy institutions in provinces and AJK:

Besides the above mentioned organizations there are several institutes which work at a provincial level. These institutes strive hard for exploration and development of energy in their respective zones.

a) Pakhtunkhwa Hydel Development Organization:

Pakhtunkhwa hydel development organization was established in the year 1986 in the name of Sarhad hydel development organization. The name was later changed to Pakhtunkhwa as a result of the change in the name of the province. The underlying aim to establish it was to enhance the hydro energy in the province. The responsibilities of the organization can be categorized mainly into three.

PHYDO as a prospector in the hydro energy.

PHYDO as a developer in the hydro energy.

PHYDO as a facilitator for the private investors in the hydro energy.

PHYDO has not only concluded feasibility studies in various districts but also have completed four major projects in Malakand ,Swabi and Chitral districts.

- Malakand III HPP - Dargai
- Pehur HPP - Swabi
- Reshun HPP - Chitral
- Shishi HPP – Chitral (PHYDO, 2013)

b) Punjab Power Development Board:

In 1995 Punjab Irrigation Department created Punjab Power Development Board. Primarily it acts as a one window facility in Punjab for private investment in the energy sector, based on any technology. It not only implements the private energy projects rather it also assists NEPRA in determination of tariffs for all the latest projects PPDB has also strong coordination with WAPDA and other institutes (Zia, 2012)

c) Irrigation Power Department Sindh:

IPDS is liable for the policies, projects and all the activities related to hydel development in Sindh province (Ali, 2010)

d) AJK hydro electric board and AJK private power cell:

The government of Azad Jammu and Kashmir incorporated AJK Hydro Electric Board in 1989.The objective was to develop the hydro power projects. Till date seven projects have been completed which have the capacity of producing 37.4 mega watts. For identification of potential sites several studies have been undertaken by Hydro Electric Power Organization, with MECO and GTZ. Similarly the same objective was given to AJK private power cell, which was established in 1996.It, also acts as a 'one window facilitator', and encourages private investment in the energy sector within the region (charles et all, 2013)

e) Water and Power Department, Gilgit- Baltistan:

Water and power department, Gilgit-Baltistan is responsible for promotion of energy projects in the area. Its responsibility begins from the maintenance of the installed projects to the development of small and medium hydel projects (Rizwan, 2010)

2.3 Energy Policies in Pakistan till Date:

2.3.1 Early 1980's: Steps towards privatization:

The need to restructure Pakistan's energy sector began in early eighties in order to over come the challenge of the energy crises. Therefore some preliminary steps were taken by the GoP. In stead of initiating generation projects to add up in the public energy sector, the government decided to privatize the sector and pool in the energy. The decision was justified because of the two main reasons

- Privatization provides a foundation for a consistent, enhanced service delivery.
- Government revenues would be gratis for health and education.

Thus in order to achieve the above two objectives from privatization, the government installed certain institutions. (Munir & Khalid, 2012)

In this connection, in the first place, a private power cell in Water and Power Ministry Islamabad was installed with the responsibility of evaluation and promotion of the private proposals. The conclusion of the projects was also the responsibility of the cell.

Secondly in the National Development Finance Corporation (NFDC), Karachi, a private energy division was formed. The prime responsibility was to keep an eye on the development fund and to grant loans for the approved projects.

Lastly under WAPDA, WAPPA (WAPDA Power Privatization Project) was created that held the duty of negotiating and managing all the agreements related to power purchase.

Moreover in the year 1992 the government of Pakistan approved WAPDA's strategic plan. The plan constituted the privatization of the power sector along with the restructuring. The objectives were to achieve efficiency, capital formation and a competitive environment.

2.3.2 Energy policy1994:

In the early nineteen nineties some more developments took place as far as energy is concerned (Munir & Khalid, 2012)

In the year 1993, energy crises began to root again and an energy shortage of 2000 MW was expected to be faced by the country in a couple of years. Thus to nib the evil in the bud, the government decided to form an energy task force, comprising a panel of skilled professionals. The task force after deep analysis issued a report, "Report of the Prime

Minister task force on Energy". Based on the results of the task force report, the first energy policy of the country was released in March 1994 (Khan, 2013).

There were three main contours of the 1994 policy.

- The prime thrust was on the private sector induction in the energy sector.
- In order to achieve the first objective, a package of incentives was given for domestic and international entrepreneurs. Following is listed a number of incentives.
    a) Choice of site.
    b) Choice of fuel or energy, including the responsibility for the supply or import of fuel.
    c) Choice of technology.
    d) Power purchase: Mandatory for KESC and WAPDA
    e) Fiscal incentives: Exemption from custom duties, corporate income tax and reduction in stamp tax and registration fee.
    f) Institutions: To facilitate 'one window facility' a private power board was established under the new energy policy.
- To eliminate the long, complex bureaucratic procedures, the government simplified the procedures to attract the investors.
- Some reforms in the corporate law and regulations were also started in order to de regulate and to provide an open competitive market economy

All these measures made an effort to make Pakistan a viable option for the foreign and local investors (Policy Framework and package of incentives for private sector power generation projects in Pakistan, 1994)

2.3.3 Hydro-energy policy 1995:

Moreover seeing the significance and potential of hydro energy, Benazir's government constituted a separate hydro energy policy, which was released in May 1995.The policy aimed at giving various incentives to the investors for generating hydro energy. The salient features of the policy were as follows:

- Choice of site for the investors.
- Choice of equipment used.
- Cooperation in feasibility studies:
    a) Could be carried out by the investor's themselves. Bound by the consultant selection criteria marked out by World Bank or Asian Development Bank.
    b) Or the investors can use the previously done feasibility studies.
- Fiscal incentives: same fiscal incentives were given to the hydro projects as chalked out by the government in 1994 policy.
- Along with the feasibility studies, an Environmental Impact Assessment (EIA) report was also mandatory, which needs to be submitted to Environmental Protection Agency (Policy Framework and package of incentives for private sector hydel power generation projects,1995)

2.3.4 Energy policy 1998:

In the year 1998, the government of Pakistan released another energy policy for the independent power projects. The aim of the policy was to facilitate the new private investors in the energy sector. It laid down the guidelines for the bidders. The policy

under the 'request for proposals' outlined all the guidelines for a competitive bidding. Moreover the policy makers made sequentially separate provisions for the hydel and thermal projects to simplify things for the bidders (Policy for new private independent power projects, 1998). But this policy failed to attract the investors to invest in Pakistan energy sector.

2.3.5 Energy policy 2002:

To meet the new demands of the twenty first century, in November 2001, the cabinet approved the formation of a National Task Force .The task force was given the responsibility of preparing a ten years "Integrated Energy Security Action Plan". The task force in their report forecasted a new energy shortfall in the coming years.

Hence keeping in view the report, need for another policy was felt by the government. Thus as a result another energy policy was released in the year 2002, which covered the private projects, public projects and public –private partnership projects.

Following were the objectives that were mentioned in the 2002 policy

- Enough energy generation, for evading shortfalls.
- Promote utilization of indigenous resources instead of foreign.
- To create a win-win scenario for all the stake holders.
- Environmental protection should be taken care (EPA, 2007).

The main features of the new policy were as follows

- Proper feasibility studies were to be carried out before bids were invited and before issuance of Letter of Support. Private sector can only conduct feasibility

studies on raw sites provided a proposal has been accepted and letter of interest has been issued.

- Hydel projects can only be implemented on BOOT basis, on the other hand thermal projects could be implemented either on BOOT or BOO basis. While it was conditioned that BOOT based projects would be handed over to the GOP at the end of the concession period.
- The investment companies had the leverage to import the equipments at concessionary rates. The government also made arrangements to exempt the companies from the taxes i-e income tax, turnover tax and with holding tax. Moreover no exemption was provided to the companies who dealt in oil fired power plants.
- Moreover it was clearly stated that in order to promote indigenization, joint ventures between local engineering industry and foreign industry will be encouraged.

Along with these main features, the policy also gives the details of bidding and tariff, with respect to the project type. (EPA, 2007)

2.3.6 Energy security action plan (2005-2030):

Further in the year 2005, the GOP approved an energy security action plan (2005-2030).The plan envisioned to meet Pakistan's energy requirements till the year 2030.Primarily the objective of the report was to give recommendations to boost the energy, by having an optimal supply mix. It was recommended that efforts should be

made to reduce the imports and making prime reliance on the indigenous resources. It was also suggested that private –public partnerships should be promoted.

2.3.7 Energy conservation policy 2006:

In the same year, National Energy Conservation Centre (ENERCON) with the assistance of Ministry of Environment issued a policy on energy conservation. The report acted as a guideline in promoting the efficient use of energy in various energy sectors. It helped to promote the energy conservation practices at all national levels. Following are the main objectives of the energy conservation policy.

- Encourage energy conservation by starting a public energy campaign.
- Regulation or energy management in all energy consuming sectors.
- Maximize supply of energy through indigenous resources
- To develop a competitive energy conservation market.
- To make the environment conducive for the sustainable growth by taking appropriate energy policy measures (ENERCON, 2006).

In this connection renewable energy policy was released by the GOP in 2006 (will be discussed in later chapters) .The main objective was to increase the energy mix by using RE. The policy aims to increase the exploitation of the RE sources. (Policy for Development of RE for power conservation, 2006)

But these all energy actions/policies could not succeed much. As a consequence of which Pakistan fell into the worst energy crises of the history. This all not only have effected the growth of economy but also have created severe unrest among the people. Capacity utilization in some sectors has dropped up to fifty percent. Energy shortages have

paralyzed the production from a number of factories aggravating the issue of unemployment, thus marking to be a national security issue. (Dalton, 2011)

Post 2007, the situation got even worst, which generated again the debate of energy within the officials. This led to a number of energy conferences throughout the country in the year 2010. One of the significant among them was the three day energy conference "Pakistan National Energy Conference-2010". The conference not only discusses the causes of the crises but also outlined measures that can help out in the energy crises.

Following were the measures that were suggested and were implemented by the government.

- Neon signs and decorative lights were banned by the Government.
- Wedding ceremonies were limited to only three hours.
- Shopping areas were instructed to be closed at 8.
- Moreover public holidays were extended from one to two days.
- Public offices power was cut to fifty percent, by allowing their air conditioning from 11 am.
- Tube wells were not allowed to operate in the evening i-e 7 pm to 11pm.

These measures were expected to save about 1500 megawatt per day.

But a number of sectors especially the business sector criticized these measures as they expected to have more economic challenges (BBC, 2010)

2.3.8 Energy policy 2013:

In order to break the ice and to tackle the crises another energy policy was issued by the Government of Pakistan in July 2013 – 2018.The policy outlines certain goals that it aims to achieve.

- Encourage energy conservation culture
- Energy sustainability
- Minimize inefficiencies and financial losses in the energy sector, and lastly
- Streamlining the energy institutions and regulatory bodies, to improve governance and efficiency.

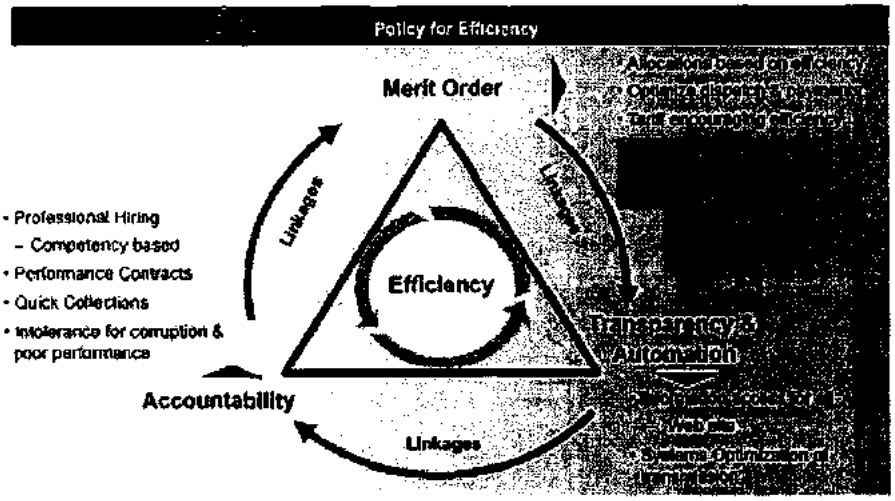
In order to achieve these objectives, the policy sets certain targets that it aspires to achieve.

- Make the supply – demand gap to zero till 2017.
- Making the cost generation to 10 c till 2017
- Limiting generation losses only to 16 percent till 2017.
- Increase financial collection to ninety percent till 2017.
- Simplify the decision making process and minimize the time period (National Power Policy, 2013).

Moreover policy principles were based on

- Efficiency: Being the cornerstone of developing competitiveness, it is founded on three pillars of, merit order, transparency and accountability. The following policy for efficiency is selected and will be followed.

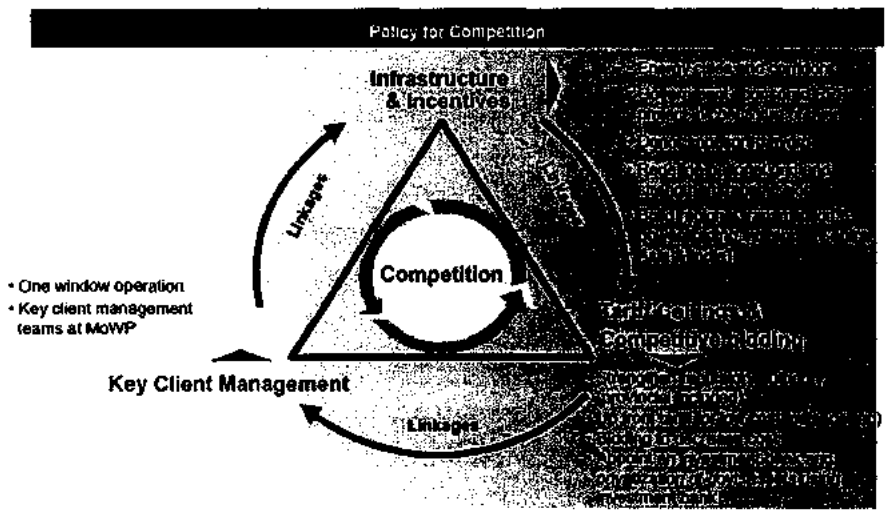
Figure 9: Policy for Efficiency



Source: National power policy 2013

- Competition: To create a vigorous energy cluster. It is founded on three pillar Infrastructure and incentives, competitive bidding and key client Management

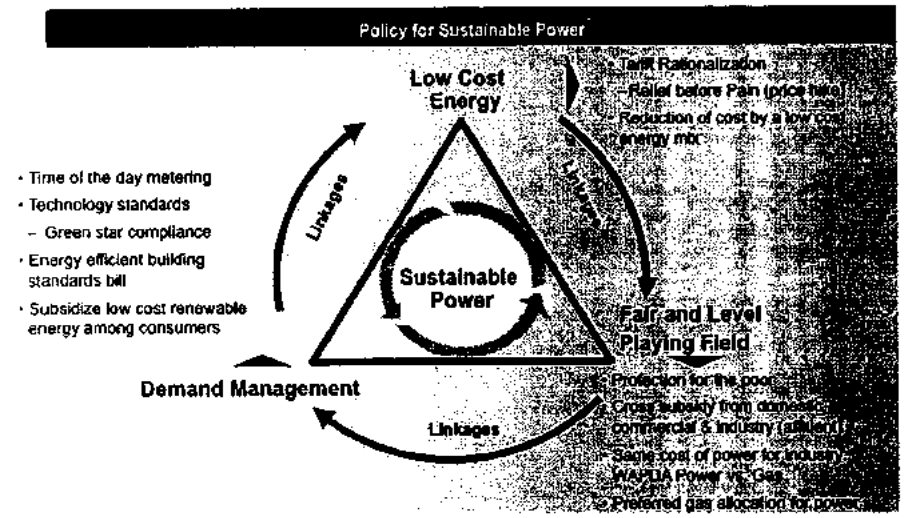
Figure no 10: Policy for Competition



Source: National Power Policy 2013

- Sustainability: It is the key for transformation over a long period. It will be underpinned on three pillars. Low cost energy, air/level playing field, and lastly the demand management.

Figure 11:Policy for Sustainability



Source: National Power Policy 2013

With in the policy framework, the policy makers have also outlined strategies to achieve each of the goals. One of them is the Supply strategy; the strategy aims to make attractive the generation sector for local as well as foreign investors. For the short term, the government has retired the circular debt and has invested in the projects that were dormant due to the lack of finances. For the medium term the strategy is to speed up all the pipelined projects by utilizing the client management system. For the long term, huge infrastructure projects will be developed.

Another significant strategy to meet the goals is the demand management strategy. The strategy aims to achieve the energy conservation and product labeling by interdicting the import of unproductive electronics. Moreover a three years exemption will be guaranteed for the local industry for upgrading the production levels to the required levels. The strategy also constitutes to cut down the activities in the evening and suggest the use of time of use metering. Another strategy that is suggested in the 2013 policy is the

affordable power strategy, which endeavors to compose Pakistan supply mix on cheaper sources, mainly: hydel, nuclear and renewable. On the other hand supply chain strategy will be used to redirect the supply of fuel to IPP's from GENCO's. This all could happen once the supply demand gap is reduced and load shedding is decreased.

In addition to the above, the 2013 strategy also provides transmission, generation and distribution strategies; along with the governance strategy that will form the basis of an efficient energy sector which in turn will form Roshan Pakistan (National Power Policy, 2013)

Besides these above mentioned policies, which are released from time to time Pakistan could not save it self from the energy shortages. With every release of the policy, the energy scenarios haven't changed much and the problems remained there. Following is discussed a number of challenges that Pakistan energy sector is been facing.

2.4 Challenges of the Energy Sector:

Pakistan is going through a sturdy time in terms of energy. The threats of the crises goes beyond the economic development and stability, jeopardizing not only the country's present, but also have put on stake the country's future.

These challenges are not only interlinked but complicated too. Currently Pakistan is facing two major societal shifts that have worst effects on the energy problem.

First change is the urbanization. Since there is high trend in the country that people are moving towards urban areas. It is expected that till 2020's almost 70 percent of the total population would have been shifted, which would further increase energy consumption.

Second shift that would worse the energy crises is the 18th amendment. This amendment has passed on, various energy related federal responsibilities to the local bodies/authorities. This paves the way for more incompetence, inefficient and ineffective policy implementation. (Kugleman, 2013)

Major challenges faced by Pakistan's energy sector are discussed below.

2.4.1 Circular Debt:

One of the main challenges in the energy sector, which is also one of the causes of the energy crises, is the circular debt. Though the government has payed off round about 503 billion in July 2013 aiming to improve the energy conditions. But the debt has again risen to 160 billion just in a span of three months (November 2013). (Haider, 2013)

With every passing month the menace and amount of circular debt is increasing In the FY 2011, the circular debt estimated about 537 billion, while in the FY 2012 it was estimated to 872 billion, rising twice the previous year. Different analysts have given different reasons that why the circular debt continues to rise. But some primary reasons at which everyone agrees are following:

- Poor governance
- Delay in tariff determination and notification.
- Along with the delay in payment by the Ministry of Finance (MoF).
- Delays infused by fuel price methodology.
- Lack of proper transmission and distribution systems (Planning Commission of Pakistan, 2013).

Other secondary reasons for the circular debt are as follows

- Inefficiency in power generation.
- Allocation of insufficient budget to transmission and distribution.
- Non professional attitude towards load management.
- Comprehensive settlement of arrears.

In order to settle the energy crises, one of the solutions is to surmount the circular debt challenge. This requires a number of steps including the reforms in the energy sector. The GoP needs to be vigilant and thus calls for redefining its role. The GoP needs to strengthens the energy sector institutions to decrease the costs, increases cash flows and make sure the competency (Planning Commission of Pakistan, 2013).

2.4.2 Lack of investment:

Energy sector of Pakistan is facing extreme under investment from past few years. Thus due to under investment very few new projects have been taken up and the existing ones have been on hold for several years now. The same reason has compelled the government not to take any up-gradation programs of the currently installed facilities. Thus the facilities are aging and causing more losses to the government (Mills, 2012).

2.4.3 Poor Governance:

One of the biggest challenges for Pakistan energy sector is the governance and management issue. The key for this challenge is a number of energy institutions which are placed vertically and horizontally with in the energy matrix. These institutions because of the poor governance are responsible for partial implementation of the energy

policies. This broad category challenge can be further subcategorized into T&D losses, corruption and federal provincial tensions.

a) T&D losses:

The most comprehensive problem in this broad category is the T&D losses, which ranks to be the highest in Pakistan as compared to other developing states. Pakistan's IESCO only faces almost 9.5 percent losses, while SEPCO faces T&D losses to 40 percent (Tirmizi, 2013)T&D losses in Pakistan can be categorized into two broad categories. The first category loss falls under the technical group while the second falls under the commercial group.

The former is inherited in Pakistan's energy system because of the mismanagement and haphazard of the T&D network. Along with the inadequate measures for renovations of the previous T&D lines.

On the other hand commercial losses are caused by the theft, pilferage and unpaid electric bills. This is caused by tinkering the meter readers and meter readings, or various other techniques for theft (Khan et all,2013). In FATA in the year 2012, only six percent of the total population paid their electric bills.

b) Corruption:

Another problem lies within the poor governance is the corruption within the energy entities. Situation gets grave day by day, putting the energy sector under severe threat.

c) Provincial-Federal tensions:

Another underlying challenge for the E sector is the ongoing provincial-federal tension. Both the entities have a strenuous relationship when comes to energy division.

The relations of the provinces are also frazzled with the federal government over the start of various hydro electric projects in the respective provinces. The biggest fear of the provinces is the in-compensation of the damages by the government with the initiation of these projects. (Mills, 2012).The government needs to take serious measures and actions to overcome these challenges, which is a major hindrance in the formation of energetic and robust E sector.

d) Lack of clear strategy and political will:

Another set of problems that falls in the energy sector is the lack of clear strategy and political will. Michael Kugleman (2013) points that the prime problem does not only lie with the framing of energy strategies and policies, but the core of the problem lies with the non efficient and inexpert implementers. The government appointed officials lack interest in the policy implementation. According to Michael Kugleman, these officials are concerned about the energy policies but implementation has never been a priority for them (Kugleman, 2013).

All this energy scenario discussion concludes on one point that is: Pakistan needs to take significant measures in order to overcome this menace. In this regard the energy analysts have recommended various suggestions and proposals.

One of the short term recommendations proposes, taking loan from IMF, starting RPP's. Another suggests of curtailing the circular debt. Another study proposes to consolidate all the energy related entities into a single entity to avoid duplication of the efforts.

While the most effective proposal suggests diversifying the energy mix. This can be done by exploiting the indigenous resources. In this regard renewable energy sources exploitation is on the top of the priority list. Since Pakistan is a country blessed with abundant renewable energy resources, all is needed to un-tap it.

Above all Pakistan needs a dedicated leadership to take bold steps and gets ready to invest revenues to trounce all the challenges (Kugleman, 2013).

Chapter Three

Renewable energy: A solution for the energy crises

Institutions and Policy

In the previous chapter it has been discussed in detail that in Pakistan, there has been seen an increase in energy demand and its consumption. Population and economic growth on one hand and new emerging markets on the other are some of the key drivers behind the increased consumption of energy.

A huge gap in demand and supply, along with the various problems like poor governance, circular debt problem, coupled with lack of clear strategies and leadership problems have created huge challenges for the country in the energy sector.

A pessimistic view is that, energy crisis is a source of generating other unremitting challenges for Pakistan jeopardizing the future of the country. But a few analysts view these energy challenges as an occasion which can be exploited for creating opportunities. These optimists think that one of the viable solutions for Pakistan energy crises is to exploit the RE, and to make it a part of the total energy mix. According to the optimistic view, for a sustainable energy future, Pakistan need to transform the energy dependence from pure traditional fuels, and needs to incorporate non renewable /non traditional fuels in the total energy equation.

Thus lately special efforts have been made and major steps taken by Pakistan in the RE sector. This chapter will briefly discuss Pakistan's development till date in the RE sector,

Pakistan's RE potential and various RE institutions. This chapter will also discuss the two RE policies released till date.

3.1 Development of renewable energy in Pakistan:

Importance of renewable energy for any state is invincible, especially in the current era of industrialization and urbanization. Developed as well as developing world both are striving hard in the renewable energy sector in order to get better the present and secure the future.

Pakistan as a developing state is considered as one of the blessed states in the world. It has abundant renewable energy sources from solar, wind, biomass, geothermal, to tidal/wave energy. But many scholars have the view that Pakistan is not harnessing these resources, moreover not making sincere efforts in the renewable energy sector.

The other school of thought negates this point of view. According to them, though Pakistan may not be exploiting RE resources to the fullest but at some level (micro) in all the empowered governments efforts have been made. The results of the efforts may not be significant but they also cannot be ignored (Chaudhry et all,2009).

This section of the chapter will accentuate the efforts made till date in the Pakistan's RE sector.

3.1.1 Preliminary stages: (1975 -1990):

It was in early 1980's through sixth year plan (1983-1988) that the country dedicated approximately fourteen million dollars in the RE sector, primarily in the fields of RE crops, and biogas. Feasibility studies for renewable energy sector were also undertaken in

this era. Institutions like PCAT (Pakistan Council of Appropriate Technology) established in 1975 and NIST (National Institute of Silicon Technology established in 1981 were prime actors for RE research and development in the preliminary stages. PCAT largely dedicated itself to the small projects like small hydro power projects, solar pressure cookers, and conversion of wind energy for running water pumps. In addition to these, some small scale biogas projects were also initiated in this period. On the other hand NIST was devoted to research and development along with commercialization of few solar projects (photovoltaic).Since these small scale projects were not applied in a good faith hence the output they gave were only up to 5 megawatt at the end of the decade (Khattak, 2006).

3.1.2 1990's decade:

In this decade, no major breakthrough could be achieved accept for few isolated promotional measures that were taken for the RE. One of the significant achievements that should be highlighted in this connection is the declaration of National Pakistan Conservation Strategy 1992; the strategy gave three major objectives for the state

a) to conserve natural resources,

b) to promote sustainable development,

c) And to manage the use of resources (Pakistan national conservation strategy,1992)

All these objectives promoted the use of renewable energy. Later on the strategy was incorporated in the ninth energy plan (1993-1998).Statistically it spent Rupees sixty three million for initiating the biogas project, wind and small hydropower projects (Pakistan national conservation strategy, 1992)

3.1.3 Twenty first century and Renewable energy:

The twenty first century saw a series of significant efforts from the government for promotion and implementation of RE in Pakistan. One of the accentuated efforts was, the signing of the support program NEAP-SP (National Environment Action Plan) for the implementation of NEAP (National Environment Action Plan) in the year 2001 between the GoP and UNDP. The support program was sub categorized into six different programs. One of the category programs were RE and energy conservation. Concrete projects were not only planned under the category but also implementation measures were taken. (Ottinger, 2013)

Further in the same year in 2001, PCAT and NIST were merged into one single authority by the name of PCRET (Pakistan Council of Renewable Energy Technologies) which extended the R&D in the renewable energy sector. (PCRET, 2013)

Further in 2003 the GoP created an Alternative Energy Development Board (AEDB), which was a national central body for the promotion and implementation of RE in the country. The board came up with the country's first Renewable energy policy in 2006, later on it was replaced with the mid term energy policy 2011.A number of significant projects are initiated under the board, which aimed to give share to RE in the total energy mix (AEDB,2013)

Moreover in the year 2005, SAARC established an energy centre in Islamabad and also established South Asia Initiative in Energy after the 13th annual summit of SAARC. The goals of these institutes were to address the challenges of energy in the region and assist each other in the energy sector. Under the six category energy programs, one of them was

energy efficiency and renewable energy. Rest of them were energy trade, adoption of best practices, rural electrification, and transfer of technologies (Pervaiz, 2013)

Further, several projects have been initiated by UNDIP and USAID and German company GTZ. All these projects are in collaboration with AEDB (Ottinger 2013)

Seeing number of efforts been initiated in the twenty first century for RE development, seems that it is an altogether a new beginning for RE. And some scholars believe that it is just a beginning RE in Pakistan needs to go much further and higher.

3.2 Institutional Structure:

A number of institutes are working for RE development both in public and private sector but some are significant .Following are some major institutions which are working for RE development.

3.2.1 Pakistan Council of Renewable Energy Technology (PCRET):

PCRET is one of the prime institutions in the country for the research and development in the RE sector. It was founded in 2001, by emerging NIST (founded in 1975) and PCAT (founded in 1981).One of the prime objectives is coordination of Research and Development in the country along with the promotional activities of RE technologies.

Other secondary objective of PCRET constitutes:

a) Adaptable RE facilities.

b) Producing RE facilities for energy usage.

c) Assisting the government in the field of RE.

d) Organizing seminars, conferences not only alone but in coordination with other international organizations.

e) Establishing liaison nationally and internationally in the RE sector (PCERT,2013)

Its head office is in Islamabad and regional offices at all the provincial capitals. The institutions also have its field offices at Abbottabad, Muzafarabad, Bahwalpur and Ghotki. The institution works closely with other welfare NGO's in urban and semi urban areas of the country. As a result of the PCRET efforts in the R&D in RE, following products and processes have been developed, that has significant usage at industrial as well domestic level.

Products

Photovoltaic

a) Solar street lights

b) Solar garden lights

c) Solar torch/portable lights

d) PV mobile charger

Solar thermal

a) Solar cooker

b) Solar dryer/dehydrator

c) Solar water heaters

d) Solar stills

e) Etc

The institution has also set targets for the country which aims to make RE in the total energy mix. (PCRET, 2013)

Following is the status of the various projects that PCRET has undertaken.

Sr.No	Type	Present status	Target 2011- 2015	Target 2016-2020
1.	Micro-hydel Plants (MHP) in Gilgit Baltistan, AJK & Khyber Pakhtoon Khah and Canal-falls	485units generating 8 MW (electrifying 70,000 houses)	5MW (electrifying 25000 houses)	20MW (electrifying 100,000 Houses)
2.	Biogas Plants Cooking, lighting Irrigation and power generation	4000 units. Producing 18000 M^3/day	50,000 units. Producing 0.300 million M^3/day	50,000 units. Producing 0.300 million M^3/day
3.	Solar Water Heaters Manufacturing through private sector with PCRET Technical services	Designed & developed 05 different models of SWH for commercialization.	10,000 units (125-260 liters each)	25000 units,125-260 liters/day
4.	Solar Dryers Manufacturing through private sector with PCRET Technical services	Designed & Developed 03 different models of 20,100 & 500 Kg capacities	50,000 units	100,000 units
4.	PV Modules Production Manufacturing through private sector with PCRET Technical services	Developed Solar Cell production capacities up to pilot scale.	5 MW	20 MW

5.	Wind Turbines 100% subsidy	155 units of 0.5-10 KW capacity electrifying 1600 houses.	1000 units /10 MW electrifying 50,000 houses	1000 Nos. 10 MW electrifying 50,000 houses

Source: Pakistan Council of Renewable Energy Technology

3.2.2 Alternate Energy Development Board (AEDB):

AEDB is another significant institute for RE development and implementation. It was established in 2003 by the promulgation of an ordinance, to implement policies, programs and projects through private sector in the field of alternate energy. It also focuses to assist and facilitate the development of RE to achieve sustainable economic growth. The institution not only encourages the transfer of technology but also places high value on producing indigenous technologies.

Primarily AEDB focuses on commercialization of the RE projects. The organization has a mandate to produce 15 percent of energy from the renewable till 2015 and hence contribute in the total energy mix In addition to the above objectives AEDB has an important function of undertaking national and international cooperation's. AEDB has on its credit to have close working relations with ADB, GEF, USAID, GTZ and UNDP. These institutes not only provide the financial assistance but also play a key role in the technical assistance. Moreover AEDB have also approached Khushali Bank and Zaraai Taraqyaati Bank to give micro scale loans to encourage the use of RE technologies in the remote areas. These technologies have been designed for remote areas to fulfill their daily electricity needs and clean water accessibility (AEDB, 2013).

The organizations also have an international membership of the Board of Directors of the world energy society and Board of Directors of the World Wind Energy Association (WWEA).AEDB is also a part of the International Solar Energy Society (ISES).

AEDB is playing a significant role in promoting an improved environment by reducing the emissions of the green house gases. For instance Gharo Keti Bander wind energy project, is aimed at reducing almost 135,000 tons of carbon dioxide. Since Pakistan has ratified Kyoto protocol thus it can benefit itself from carbon trading.

One of the major accomplishments of AEDB is the making of renewable energy policy for the state, which was released in 2006.The policy objectives stated is to have energy security, economic benefits, social equity and environmental protection. Specific objectives include the generation of 9700 mega watt energy by the end of the year 2030. Policy aims to give friendly investment incentives for the promotion of RE. The policy was replaced by a mid term energy policy in December 2011.In the same year an AEDB act 2011 was promulgated which enhanced the responsibilities of the institute (AEDB, 2013)

3.2.3 Renewable and Alternate Energy Association of Pakistan (REAP):

REAP acts as a private advisory body for the government and private sector for RE development. It assists the various organizations in RE policy development, consultancy, and feasibility studies. It also plays important role in technological assessments and road map development. It also acts as a platform for all international technical collaborations (REAP, 2013)

3.2.4 Others:

Besides these two prime institutes, there are a number of other organizations and set ups for which the development of RE is of key priority. In this list a number of cells with in the various institutes/universities can be accentuated.

a) Agha Khan Rural support Program (AKRSP):

Another significant organizations is the Agha Khan Rural support Program(AKRSP), which since 1991 has completed 240 micro and mini hydel projects with in the northern areas of the country (Fayyaz,2012).AKRSP has provided the technical and financial assistance for these projects and also have been involved in training of the community personals for the maintenance of these projects. AKRSP has been awarded the green Oscars and a Japanese award for the services it provides to its community (Rehman, 2007).

Beside AKRSP, various cells have been established with in the various universities which are promoting RE research and development for instance EME, college of NUST .This institute has been involved in installation of solar technologies in various parts of FATA, Balochistan and Azad Kashmir. Currently the institute has directed its efforts on Bio diesel extraction, waste heat and energy efficient building designs. Other institutes include GIK institute Topi, KPK, BZU, physics Department of Gomal University and QAU. These all involve in R&D efforts for a safer, energy sufficient country (Iqbal, 2010)

3.3 Potential of RE in Pakistan and status of the various projects:

The soaring oil prices, depleting gas reserves and rising energy demand has pushed the policy makers to explore the renewable energy option of the country. Pakistan is one of

the states, who have abundant RE sources i-e solar, wind, biogas, geothermal and hydro. Estimate wind can produce approximately 350,000 MW; while solar can produce about 2.9 million MW. On the other hand 2500 MW can be produced by the geo thermal source (Sheikh, 2010).

This section provides an over view of the potential and the available RE resources.

3.3.1 Solar Energy:

Energy from the sun is the most commonly found and commonly used form of energy world wide. Earth, with being receptive of 100,000 TW of solar energy per day, is the most abundant form of energy. Schiermeier (2008) and others in their work, "Energy Alternatives: electricity without carbon" has discussed that world's primary energy needs could be fulfilled by only one tenth of the Sahara desert. The energy from sun can be achieved through various technologies. But there are three wide categories.

a) Passive solar design: It involves the use of floors, windows and walls for absorbing solar energy and then involves distribution of the energy. In winters the energy is distributed in the form of heat while in summers the solar energy is rejected. Hence the technology is used for heating and cooling purposes in dwellings.

b) Active solar thermal: It involves the absorbing of the solar rays that could be later used for various purposes including electricity generation. It primarily involves the concentrated solar thermal systems for collection of the sunrays using flat collectors, evacuated tube collectors and mirrors.

c) **Photovoltaic**: It involves direct conversion of solar energy into electricity by making use of the photovoltaic effect. The effect involves the use of silicon cells that is used for solar ray's concentration (Jackson, 2000).

Pakistan is one the blessed countries, who has abundant solar energy, with fewer cloudy days. According to the world metrological survey, per year Pakistan receives sunshine of 15.5 into 1014 KWH, one of the highest in the world. While sunshine hours mount to 1500-3000 hrs yearly, this constitutes to 9 to 9.5 hours per day (Adnan et all, 2012). According to a report published by Solar Energy Research Centre (2010), Pakistan is the most feasible state for solar energy. The report suggests that only if 0.25 percent of Balochistan is covered with solar panels it would be able to meet the country's primary energy demands. The report highlights since seventy percent of the population lives in the rural areas thus it is easy and cheaper way to electrify them with solar panels rather than using the grid system. Gibbs and Hussain (1990) research work has also endorsed the SERC report, by highlighting the importance of the RE technologies specially the solar technology for the rural areas. Similarly Mirza and others (2003), research have pointed out to the fact that though with high potential of RE resources, Pakistan is still behind so many other states in terms of its usage. Unlike Mirza, Sahira and Quraishi (2008) points that political-socio barriers coupled with financial and policy barriers are major source of lack of development of solar energy.

Some of the major projects have started already. Till now; Pakistan has no major and big commercial solar panel distribution system. But some small projects have been undertaken by the government and AEDB. In these, includes the

- Rural electrification program initiated by AEDB

- Parliamentarian sponsored village electrification program
- Ground water pumping program
- One of the major break through came up in 2010, when AEDB and Chinese company CTGPC signed a MoU for producing 300 mw of energy through solar power in Punjab and interior Sindh (AEDB,2012)
- Moreover Pakistan and Canadian government broke a deal of producing 500 MW energy through solar panels in Quaid-e-Azam Solar Park Cholistan in the year 2013.In the first phase of the project 200 MW energy would be produced within the first year, while the rest would be completed in next two years.

  This park is supposed to attract almost two hundred billion rupees investment from various international investors (Mohsin & Hameed, 2013).

Along with these efforts Pakistan has also established a solar panel manufacturer facility near Taxila. It has also gone under a partnership with Germany for establishing another solar panel manufacturer facility (Rana, 2013). Looking at Pakistan solar energy potential, it can be concluded that though the country has a very high potential, but it has been unable till now to un-tap it fully and to take advantage of it.

3.3.2 Wind Energy:

Another cleaner and non pollutant renewable energy source is wind. It is not being used recently to fulfill a state's energy demands but the use of wind for energy fulfillment can be traced back to 500 AD. It was the then used for grinding and pumping purposes in Persia. On the other hand the Europeans and Dutch have been using this energy since 11th century (Dodge, 2013).

Recently the concept of wind energy has been revived and used by developed as well as developing states. In this connection China is on the top of the list, since it is one of the largest manufacturers of wind machinery (World Watch Institute, 2010).

Pakistan is also one of the blessed countries in the world, who can derive abundant energy from wind .Since the best areas for installing wind turbines are the areas, where there is uninterrupted flow of wind i-e most suitably the areas near water, thus Pakistan's coastal areas are considered to be the best. According to a recent report by USAID, Pakistan has a total potential of producing 150,000mw of wind energy, which would be able to bring an investment of 2 Billion dollars. (Dawn, 2013)

Meteorological research based on the data of twenty wind monitoring stations, identifies coastal areas of Gharo and Keti bander as the most potential areas. The report discusses that these areas are able to produce 40000 and 50000 mw of energy. Some parts of Balochistan and Northern areas have also been identified for producing wind energy (Dawn, 2013).

Moreover Karachi and Islamabad areas the wind speed ranges from 6.2 to 6.9 meters per second and 6.2 to 7.4 meters per second respectively, thus ideal for wind energy (AEDB, 2012).

Pakistan is recently taking keen interest in producing wind energy. In this regard it has started a number of projects too. Following is list of all the wind energy projects initiated by the Government of Pakistan.

- One of the pioneer wind energy projects have been started in 2012 in Jhimpir, district Thatta. The project which is a joint collaboration of AEDB and FFCE would be able to produce 50 MW of energy.

- Another significant project which has been started by AEDB is a joint venture of Zorlu Enegi Company Turkey and AEDB in Karachi in the year 2012.The project is able to add up 56.4 mw of energy in the national grid by the end of the completion.
- CTGPC, China and AEDB have signed a MoU for installing 2000mw wind energy projects, which will be a significant step in Pakistan wind energy programs (AEDB, 2013).
- Lately, AEDB has approved a plan to establish new park energy phase I, wind project near port Qasim. The project would be able to achieve 400 mw of energy.

The government of Pakistan has delineated to have a 2500 mw of wind energy at the end of the year 2015 (The Nation, 2013).

3.3.3 Bio mass energy:

Bio mass energy has been given the status of clean, renewable energy. It comprises of all the residues of plants even aquatic plants, and animal's manures and other agricultural wastes. Rapid urbanization in the recent years has given birth to one of the threatening problem i-e of wastes. But thanks to the technological developments that waste these days can be combustion to produce cleaner energy thus, these wastes along with other mentioned residues can be used as an important renewable source of energy (Biomass energy centre, 2013)

3.3.4 Bio Gas:

Bio gas is one of the important sources of bio mass energy, which is produced by using the animal dung/manures. It not only provides cleaner gas for everyday use, but also provides enriched bio fertilizers (Biogas centre, 2000).

Pakistan has a total livestock of about 159 million, which amounts to almost 652kg of manure (only buffalo and cattle) per day (Livestock census, 2006). According to a research, the fermentation of 652kg dung is enough for producing 16.3million cubic m biogas per day and 21 million tones of bio fertilizer. This amount of biogas is enough for 50 million people everyday use. Similarly Pakistan has also potential of producing biogas from rice straw, cotton gin, street and slaughter wastes and paper industry. Thus bio gas is one of the most viable options for a country like Pakistan. Biogas has technological benefits as well as environmental benefits (Amjad et all, 2011).

The government of Pakistan initiated a Biogas support program (BSP) in early 2000.The project endeavored to install 1200 household biogas units. After the initial success now it aspires to install another 10,000 units in the coming years (Ilyaas, 2006). On the other hand Pakistan Dairy Development Company has also undertaken the biogas installation project to give cheaper gas to the rural areas. Till 2009 under the project, 450 biogas units have been installed and the number has been increased to 556.Another program by the name of "Rural Support Network Program" was also initiated by the Government of Pakistan for biogas development (Amjad et all, 2011)

Furthermore AEDB is also playing pivotal role in promoting biogas by acting as one window facility. Following is the list of projects initiated by AEDB on behalf of the government of Pakistan.

- AEDB and Lumia Energia Pvt Ltd have initiated a project of 12mw bio gas plant, based on agricultural wastes in Jhang, Punjab.
- Another 12mw biogas plant is under construction in Mirwahgorchani town, Mirpur Khas, Sindh. This is a joint project of the local and US entrepreneurs.
- At Mathli Sindh, another 09 mw of bio gas plant is being initiated with the help of Pak Ethanol.
- LOI has also been issued for establishing 12mw biogas plant in Faisalabad, Punjab and Mardan, KPK (AEDB, 2013).
- A major advancement came up in 2013, when UNIDO with other Pakistani private partners launched the project under the title "promoting sustainable energy production and use from biomass in Pakistan" funded by 1.8 million dollars by GEF. Under the proposed project, UNIDO will set three biomass gasification demonstration projects at Kamoke, Jhelum and Thatta. The aim of the demonstration projects will be to enlighten that biomass gasification is a viable and economic option for even small and medium enterprises (Naeem, 2013).

3.3.5 Hydro energy:

Hydro is another cheapest and cleaner form of energy. Pakistan though being blessed with hydro energy has very fewer large projects, thus the potential remained un-harnessed. Three hundred potential sites for hydro projects have been identified by a metrological survey. Out of these three hundred, Pakistan has only utilized twenty. There are five big projects at Mangla,Tarbela,Ghazi Barotha, Chashma and Warsak ,while other fifteen small and medium size projects are under operation at various parts of the country.

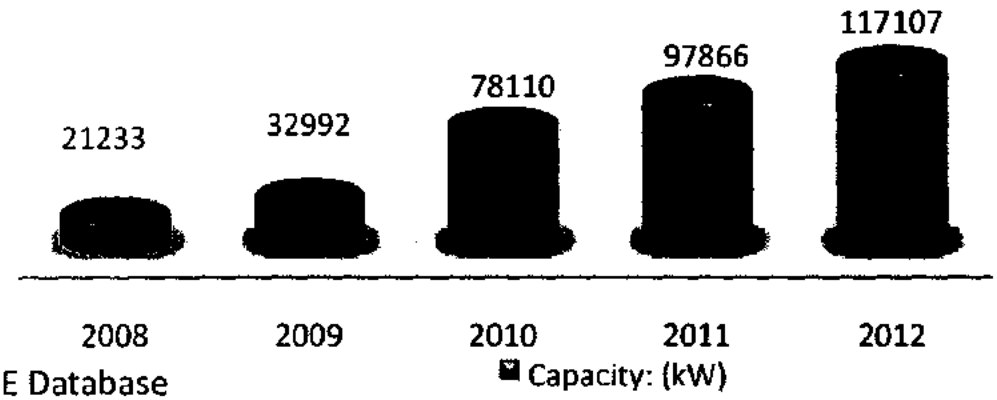
These twenty constitute almost nineteen percent in the total energy mix (Pakistan Economic Survey, 2011).

In the year 2001, WAPDA undertook a survey study and identified twenty two potential sites that were able to add up 15074 mw of energy in the energy mix. These potential projects were also able to meet country's growing agricultural demands. But these projects remained on paper and never materialized because of the financial constraints (Khan, 2013).Many energy experts like Carl Pope has recognized that for countries like Pakistan micro hydro projects are the best solution. He has highlighted the northern areas for these projects. According to him, micro hydel projects are not only financially affordable but also easy to maintain (Khan, 2013).

AEDB is one of the major facilitator and implementer in the micro hydel projects. Because of the efforts of the institute international donors like EU have allocated handsome funding.

AEDB have also initiated a number of micro projects with the help of UNEP and GEF. Under the PURE micro hydro project UNEP and GEF have invested one million US Dollars and AEDB acts as major implementer. According to the official figures AEDB has initiated about 103 min/micro hydro projects in Chitral and Gilgit Baltistan areas. The below chart shows the total micro hydro installed capacity (AEDB, 2012)

Figure 12: Total micro hydro installed capacity



Source: RE Database

In March 2013, the government inaugurated the first hydropower project under the UNCDM project. The 'new Bong escape project, Mirpur Azad Kashmir is able to produce 84 mw of energy (AEDB, 2013)

3.3.6 Tidal Energy:

Tidal energy is one of the significant forms of hydro power renewable energy. The central idea is to get the energy produce in the tides. Thus tidal power stations works on the design of windmill. The tidal energy unit acts as under water wind mill. Tidal energy is not a novel idea of the twenty first century rather the first large tidal station was established in France in 1966 by the name of "Rance tidal power plant". Later on others replicated the design and it became a universal renewable form of energy (Charlier & Finkle, 2009).

Pakistan in the tidal energy context is lagging behind everyone. Though with a huge potential present at its 1045 km long coastline, it has not planned any project yet. According to the study (2012), "Feasibility Studies for the extraction Of Energy from Current and Halio Hydro Gravity along Pakistan Coast" conducted by National Institute

of Oceanography (NIO) suggested that only the creeks near Karachi have the potential of producing 17478mw and 280 mw energy. The research was conducted in all major creeks in Indus Delta and found that these creeks can produce energy of 900 mw.

According to the other various researches, four creeks in Sindh and Balochistan are significant. Creek system of Indus delta and Korangi creek has a huge potential of tidal energy. Similarly in Balochistan sonmiani and kalamat have also been identified (NIO, 2012).

In the year 2012, a Norwegian company by the name of Tide tec, offered Pakistan to harness its tidal energy potential. But no further advancement was made in this context later on (The Express Tribune, 2012). With a significant potential of tidal energy and looming energy crises, one wonders that why Pakistan has not exploited this environment friendly renewable energy.

3.3.7 Geo thermal Energy:

Geo thermal is another form of cleaner, environmental friendly renewable energy. It is basically the energy extracted from the heat of the earth. Most of the geothermal energy is found within the seismic belts. The energy derived from these seismic belts can be later used for various purposes especially used abundantly in the electricity production (Renewable Energy World, 2012).

In the context of Pakistan, geographically there is a long seismic belt that passes through, which confirms the presence of geothermal energy. According to the researchers the geotectonic framework of Pakistan suggests that the country should not be missing the commercially exploitable geothermal energy sources (Ahmed & Rashid, 2010).

Pakistan has also hot springs in its northern areas, while only in the Balochistan area eighty mud volcanoes have been identified.

Pakistan has undertaken a limited study on three important phases of the geothermal exploration.

a) It has identified the geo thermal phenomenon.

b) Has classified the geothermal field production.

c) Productive zones identification (Ahmed & Rashid, 2007).

Though Pakistan has a potential of geothermal energy, but no serious effort has been made to make geothermal as an alternate energy source.

3.4 Renewable Energy Policies:

RE has been on the priority list of all the governments that have been in power till date. But very less sincere efforts have been made to develop it to its maximum. That is why that besides an RE policy, issued in 2006.and a midterm policy released in 2011, Pakistan is still lagging behind the RE development.

This section of the chapter provides an overview of the two RE policies released till date.

3.4.1 Renewable Energy Policy 2006:

The government of Pakistan with the assistance of AEDB issued the country's first renewable energy policy in 2006.The objective of framing a policy was to ensure the exploitation of RE sources in the country and to make them a part of the total energy mix. The policy aimed to produce a total of ten percent energy till 2015.The policy limited itself to the solar, wind and small hydro power projects (50mw or less than). 2006 policy

agreed to the fact that other RE sources is present in Pakistan for example biomass and geo thermal, but the policy did not address them.

Besides short policy goals and objectives, the policy also outlined four strategic objectives, which it aimed to achieve in the long run. Following are the four main strategic objectives of 2006 RE policy.

a) Energy Security:

Renewable energy can play a pivotal role in sustainable supply of energy hence promoting energy security. The aim of Pakistan is to mainstream the renewable energy resources, to make Pakistan more reliant on the indigenous resources. This will also help in decreasing Pakistan's acute reliance on the conventional imported fuels.

b) Economic Benefits:

Use of RE cannot only contribute in the state's energy security but its role in the economic development and benefits is significant and cannot be marginalized. This is truer for the underdeveloped or rural areas where conventional energy costs more than the renewable energy. RE in these areas can also lays the foundation for job opportunities; enhanced productivity for the locals and can improve their standard of living.

A decentralized RE setup can also help in minimizing the transmission and distribution losses. Growing and flourishing RE industry can also perk up the employment and investment opportunities for the local manufacturers and entrepreneurs.

b) Social Equity:

Pakistan shows a very dismal picture when it comes to social equity. The issues of poverty, equal rights and access to basic facilities, energy supplies have complexed the social equity equation. Thus deployment of RE technologies will help to decrease these issues making the social equity equation better. It can improve the conditions of the under developed sector of the country.

c) Environmental Protection:

Traditional conventional fuels came up with its own set of problems in the form of environmental issues. In order to conserve the environment the use of RE is encouraged through out the world. Since Pakistan is a signatory of UNFCC thus preserving the environment / climate is the main responsibility and target (Policy for development of renewable energy for power generation, 2006).

The policy enlightens that the above four mentioned strategic objectives could be achieved through a specific development strategy, which it has outlined with in the 2006 policy. The guidelines of the development strategy were:

- Maximize the deployment of RET's, to maximize its proportion in the total energy mix i-e to achieve 9700 mw till 2030.And works towards the universal access to electricity in all the areas i-e both urban and rural.
- To meet the growing energy demands, additional supplies through RET's should be provided.
- Promotion of friendly investments to foster the new RE market and then later on decreases the prices gradually.

- Develop measures that would help the private sector to endorse the public sector in their investment.
- To merge RET's with the social welfare, especially for the under develop areas.
- Assist in installation of RE technical, financial institutions.
- Establish RE manufacturing base.

AEDB took an evolutionary phase when comes to RE development. In this regard the policy development and implementation was segregated into three terms.

a) Short term.

b) Medium term.

c) Long term.

a) Short term:

AEDB under the short term planned the activities that could lay the foundation for a vibrant RE sector. Major focus was laid on the readily available RE sources and commercially proven technologies that could be exploited immediately. Highlight for that was the solar, wind and small hydro projects. This phase aimed to give liberal incentives to attract the investments. Forming a vigorous regulatory body along with the development of a market, capacity building, pilot testing and facilitation measures all were designed to be taken under this phase.

During the short term, the public sector would be given the responsibility to identify the potential sites. Specially those sites which are far flung under developed, and needs assistance in energy sector. These potential sites would be in Balochistan, interior Sindh, some parts in KPK, FATA and AJK. Projects under these sites would be financed either by the public sector or by the donor communities.

On the other hand private sector would be given incentives to invest liberally in the RE projects. Private sector was given free hand to take up any projects from the following category.

First: independent Power Projects.

Second: Captive and Grid spillover projects

Third: Captive power projects

Fourth : grid power projects

General incentives for all of the above projects were as follows.

- **Mandatory purchase:**

For all the power utilities, it was mandatory to buy electricity from the RE projects that was being offered to them. Thus providing a guaranteed market for the RE projects.

- **Wheeling:**

The RE producers can enter into direct sale agreements with the end users. Under this they can sale a specific part directly to the end consumers, while the rest they can sale to the distribution companies. But for the former they had to pay wheeling charges. Practically speaking, IPP's can insert electricity at one point and will be able to receive same amount at any other point on paying wheeling charges, which is to be determined by NEPRA.

- **Production incentives:**

A special bonus payment will be given for all the productions of RE IPP's, if they produce above benchmark production.More over all projects who are entitled for CDM

financing will be supported for CER credit registration. Along with this the power purchaser will be bond by a power purchase agreement with RE producers.

For all the RE projects financial and fiscal arrangements were made, applicable for both public and private projects.

- All the RE technologies and spare parts for maintenance can be imported, free of custom as well sales duty.
- Exclusion of the income tax, turn over tax and with holding tax.
- All the non residents and non Muslims will be exempted from zakat.
- Investors would be informed about the risk and profitability by the private agencies.

In case of unsolicited proposals for RE IPP's, first a letter of intent will be issued, which would allow them to undertake feasibility studies. The feasibility studies would be reviewed by the panel of expert's. After reviewing it would then later generate a generation license. Financial closure for the project would be achieved by issuing a Letter of Support.

On the other hand for all the solicited proposals bids would be invited, to craft competitive bidding. But before commercial bidding, qualification of the bidders would be seen. AEDB along with other entities would be allowed to set a pre bidding conference for the exchange of information to seek clarity in the project. Later on the successful bidder would be issued a letter of support. All the process would take place in coordination with NEPRA.

For both the solicited or unsolicited proposals, after the issuance of LOS, the sponsors are bond to do certain activities

a) Sign the IA and CERA with AEDB, also needs to sign power purchase agreement with power purchaser.

b) Attain financial close and start construction.

c) Carry out the project with full honesty as outlined in the LOS.

In case of the default from mile stone, AEDB would be allowed to cease the LOS.

For all the grid connected RE IPP's a special security package was formulated, which involved the protection against political risks, changes in tax or duty regime. It also involves protection against RE variability.

The policy also gave a short framework for the medium and long term as a development strategy.

b) Medium term:

The time framework for medium term was 2008 till June 2012.The policy document stated that since Pakistan would have gained a short RE experience in few years, which would help them to formulate a more comprehensive RE medium term policy. The aim of the medium term policy is to have systematic implementation of the RE technologies and scaled up capacity.

The policy stated that midterm framework would provide a more competitive RE market.

c) Long term:

The long term comprises of the time framework after June 2012. By this term renewable energy would be a significant part of the nation's energy mix. Use of RE would be widespread with a remarkable service base and local manufacturing (Policy for development of renewable energy for power generation, 2006).

Thus the policy provided a full framework for the RE development. But unfortunately the Government could not meet the desired and set objectives of the 2006 policy. According to AEDB external factors played a significant role in not achieving these objectives. According to the official stance, 2006 policy was a good start. But since circumstances began to change in early 2007 especially the dramatic rise in the oil prices, which provided incentives only for those states who already had an RE policy intact. Later in 2008, the circumstances again began to change with falling of world oil prices. With the collapse of US housing market followed by problems in the banking sector, the credit began tightening and FDI start declining. Thus all these external factors effected the RE development coarsely.

3.4.2 Renewable energy Policy 2011:

The mid term policy that was due in 2008, was released in March 2011.The policy was formulated by AEDB, with the help of GTZ, USAID and Asian Development Bank (AEDB, 2011).

One of the significant characteristics of the ARE policy 2011, was that it widened its scope by encompassing the

d) Alternative fuels (Bio gas, Biomass, bio fuels, Hydrogen and waste) and
e) ARE fossil fuel Hybrid System (system using conventional as well as ARE resources, where ARE contributing 70 percent)
f) Along with the renewable energy, this extended its scope to geothermal, tidal and wave too.

The main objectives that ARE 2011 aimed to achieve were as follows.

- Sustainable and systematic development of ARE and harmonization of efforts through effective coordination between federal and provincial governments.
- Make available additional supplies to meet the growing demands.
- Maintain and introduce investment friendly incentives.
- Encourage the use of ARE technologies for domestic purposes.
- Encourage ARE based energy solutions and service delivery /social welfare.
- Scales up capacity building of the entire ARE projects.

Five percent share in the total energy mix by the end of the year 2030 is the target set by 2011 policy. But this target is open to amendments from time to time (Alternative and renewable energy policy, 2011).

One of the unique features of the 2011 policy was the inclusion of carbon credit feature. Pakistan being signatory of the Kyoto Protocol is bound by the CDM. Thus the GoP promotes all the ARE projects developers for acquiring carbon credits through CDM. AEDB would facilitate and coordinate with all the developers and would use an effective approach. Under the policy AEDB was assigned to formulate a carbon credit mechanism. Moreover AEDB under the policy was instructed to collect all the RE resources data, that need to be updated from time to time. The data will be available readily for all the potential investors.

For the entire grid connected ARE projects, guaranteed market was formed by making electricity a mandatory purchase. On the other hand for ARE IPP's license issuance rules and regulations were simplified. Moreover facilitation and coordination would be provided for land and site access. Seeing the success of feed in tariff for prompt investment globally. The GoP under the 2011 policy announced feed in tariffs for ARE

projects. Moreover for all the ARE projects, specific incentives of wheeling, net metering, grid spill over and banking are formulated.

In addition to the above, in 2011 policy a premium clause was induced which is: to give extra benefit of premium on all ARE projects. AEDB has been instructed to work in coordination with NEPRA for the development of premium parameters.

Furthermore for all the ARE IPP, for both the solicited and unsolicited proposals the procedure remained same as was designed in the 2006 policy.

In 2011 policy special arrangements have been made to accentuate the use of alternative fuels rather than the conventional fuels. The main objective stated in the policy is to reduce dependence of Pakistan from the conventional imported fuel. The policy highlighted main alternative fuels that have significance for Pakistan. Those are Biogas, bio fuels (bio diesel and ethanol), fuel from waste and hydrogen. The objective is to make ten percent of bio diesel in the annual volume of diesel fuel by the year 2025.

For the first time in the 2011 policy, special efforts have been made for social awareness and demonstrations. AEDB has been involved in all awareness programs and has been allowed to collaborate with other research or academic institutes to promote R&D efforts. Role of EPA and its involvement in every ARE project has been made mandatory (Alternative and renewable energy policy, 2011).

Thus besides the significant potential of RE and a number of efforts, with the policy intact, Pakistan has not achieved major results in the RE sector. The share of solar, wind, geothermal, tidal and biogas in the total energy mix is negligible. So the question here arises why is it so? What are the barriers in the RE sector and in RE policy implementation that gives a set back to the sector.

Chapter Four

Analysis of Renewable Energy policy

Challenges and strengths

For ensuring a sustainable future of Pakistan, it is necessary that great importance should be given to the energy sector and its institutions and to make them strong. One of the ways for a sustainable energy sector is to rely more and more on the indigenous resources and to formulate fine policies and strategies for it. The other part of the strategy is to implement them strongly in an honest manner.

Relying more on indigenous resources (i-e the Renewable energy) means not only more economic growth but their use also helps to raise the standard of living, alleviate poverty and lay foundation for more environment friendly communities (Mirza et all, 2009).

Since it has been discussed previously that Pakistan has a significant RE potential, and it has devised measures to make it more robust and vigorous. One of the significant breakthroughs came in the form of RE policy 2006 and later the RE policy 2011.

But the problem here lies is that besides these measures Pakistan have not achieved remarkable results. This has raised several questions on the RE sector. This chapter will briefly analyze all the factors that have led to a weak RE sector in Pakistan. It will provide a deep analysis of the various challenges that halts the efficient implementation of the RE policy.

4.1 Challenges to RE policy implementation:

Pakistan has attain a major achievement in the RE sector by formulating the state's first renewable energy policy in 2006, which was later replaced by 2011 policy.

Though 2011 policy was due in 2008 but due to external and internal factors the goal couldn't be materialized. If we look at both the policies we will realize 2011 policy is much mature than the other one. It has expanded its scope by incorporating almost the entire ARE sources, accentuating the rural energy services and bio fuels. One of the significant features of the ARE 2011 was the resource data bank and the importance of the awareness and promotional programs. Another significant feature that was encompassed was the feed in tariffs. It is one of the policy mechanisms for accelerating RE investments by assuring to buy and pay for electricity produced for a longer period. Only in the year 2012 sixty five countries all over the world introduced the feed in tariffs, which accelerated the wind installation to sixty four percent and PV installations to eighty seven percent.

But besides many positive features of the policy, the policy could not been able to achieve much success. If we look at the RE sector through development phases we will conclude that Pakistan RE sector is still in the mid between inception and take off phase (when market grows rapidly, widespread deployment of RET's) and the consolidation phase cannot be achieved in the near and far future.

The policy analysts blame the implementation phase of the policy for being ineffective and unsuccessful. They have identified the various implementation barriers, and have suggested that if removed accurately, a robust and vigorous RE sector could be achieved.

Broadly the various implementation barriers can be categorized into two.

- Firstly the economic barriers/cost barriers.

The economic barriers or the cost barriers can be categorized into the following: lack of competition with the conventional power systems, lack of finances, market barriers and others.

- Second category consists of non economic barriers/non cost barriers.

The non economic barriers which are also called non cost barriers can be further categorized into the following: political barriers, regulatory barriers, institutional barriers, poor infrastructure, poor information and technology access, lack of capacity and training and lastly the lack of social awareness and acceptance (UNFCC, 1998).

Following is discussed in detail the implementation barriers.

4.1.1 Cost barriers:

a) Lack of competition with conventional power:

One of the foremost challenge with respect to the slow RET's take up in Pakistan is its lack of competition with conventional power. Besides a number of fiscal incentives, RE is still expensive as compared to traditional fuels. One of the factors is that Pakistan has limited RE manufacturing base, which compels the state to import the RE technologies. This makes the cost even larger. Since the RE initial cost of the RE deployment is higher as compared to others, thus makes it a less opted option (UNFCC, 1998).

A COMSATS (2005) study on RE deployment sum it up in these words:

> If it had not been for the larger capital involved in installing a photovoltaic (PV) cell power plant (in Pakistan), it would have been a very clear winner in (terms of) economic comparisons.

Another major reason for RE being disadvantaged in Pakistan is that the conventional fuels are highly subsidized. The government purchases the power from these plants at a higher

rate pushing RE at disadvantage. Furthermore, since subsidies decrease the prices of the conventional fuels, thus it makes the high capital RET's marginalized (Haq, 2008).

Mashal Yazdanie has illustrated this point using the classical supply and demand model. According to the model the RE equilibrium price and quantity is high as compared to fossil energy. On the other hand fossil energy equilibrium price and quantity after and before the subsidy clearly indicates that after applying subsidy the cost is reduced. Hence increasing the gap between RE and fossil energy (Yazdanie, 2010).

Another important factor in this regard is the exclusion of the positive and negative externalities. Fossil fuels prices are free of external costs (negative) like air pollution, health and environment. These negative externalities pushes the conventional fuels at disadvantage but the reality is different .Besides the negative externalities it is not marginalized. RE positive externalities of social and environmental benefits are not accounted either in the pricing mechanism, thus facilitate in marginalizing (Yazdani, 2010). These factors altogether makes RE unable to compete with conventional fuels. Moreover besides many incentives in 2006 and 2011 RE policy, the RE sector could not achieve much success. These factors hamper the deployment of a robust RE sector.

b) Financial Barriers:

Another important challenge in the RE policy implementation is the lack of adequate finances. Since RE has a high initial cost, which hinders the emergence of a vigorous market hence posing challenges for its implementation. In the context of Pakistan RE policy, financing issue is further driven by so many factors.

- Firstly the lack of awareness in the context of renewable energy technologies.

- High risk assessment.
- Resource assessment uncertainty (Mirza et all, 2009).

Moreover since the financial support is limited only to the partial capital cost of the project (reason: lack of finances) excluding the maintenance costs and customer care thus it makes them unattractive for the investors. Many scholars believe that the high initial costs of the RET's makes it unsuitable for the countries like Pakistan. More over since there is limited governmental and international support for large scale RE projects because of the country's circular debt problem, thus posing huge challenge for the country (Mirza et all, 2009).

c) Market barriers:

In the context of Pakistan, RET's penetration in the market is limited because of the RET's competitive disadvantage and traditional fuel power producers ascendancy. The subsidies given to the conventional fuels and the failure of internalizing the external costs (health and environmental damages, pollution and climate change factors) pushes the renewable to be incompetent in the playing field (Khattak et all, 2006)

Another major challenge in the Pakistani market is the limited marketing in terms of awareness campaigns. More the market is expanded, more would be the use of RET's (Mirza et all, 2009).

4.1.2 Non Cost Barriers:

a) Institutional barriers:

Institutional barriers are one of the most significant sub category barrier which halts the efficient implementation of the RE policy. Though it is generally considered that the

institutions play a significant role in promoting and implementing any policy, but there are circumstances where the statement becomes untrue. In these cases institutions instead of promoting cooperation and coordination, becomes tangent to each other.

These institutional barriers are not only a great hurdle in the developing countries rather developed states is also facing such barriers. One of the most noteworthy studies in this regard is done recently by ECORYS for identifying non cost barriers in the EU states. Their study concluded that among the non cost barriers the most significant are the institutional and administrative issues. The involvement of so many institutes and the time consuming permission slips not only negatively impact the RE developers individually, making the cost higher. Moreover they impact the society as a whole. For instance in Greece, Spain Hungary, Italy takes three to six years for initiation of RE projects. Another study on EU suggests that only four out of twenty seven countries would be able to achieve their RE targets by 2020.Although figures may improve by three percent if measures are taken to mitigate the institutional barriers (ECORYS, 2010).

In another study conducted by IEA in AEAN six (Vietnam, Singapore, Thailand, Indonesia, Malaysia, Philippines) concluded that in ASEAN six the most significant barrier after infrastructure issues is the institutional. The study recommended that one of the key priorities for the policy makers in these states should be removal of these hurdles (Olz & Beerepoot, 2010).

In the context of Pakistan, institutional barriers are also more significant. One of the major issues in this regard is the lack of coordination and cooperation with in the various energy related institutions. Pakistan currently has the major institutions like ministry of water and power, ministry of petroleum and natural resources, HDIP, NEPRA, AEDB, PCRET, PPIB,

ENERCON, various power utilities, energy wings and centers in federal as well as in provinces. The cooperation between all these institutes is a major challenge. One of the major reason for merging NIST and PCET into PCRET was the lack of effective of cooperation and coordination (Khattak et all, 2006). Similarly according to Mashal Yazdanie (2010) besides having a joint goal, very less coordination exists between AEDB and PCRET. Umer K Mirza and others (2009) have reviewed the past institutional practices in the country and have concluded that RE institutions which are in charge for implementation of RE projects take steps and are active independently.

The problem magnitudes further because of the 18th amendment, which makes the provinces and federation joint holder of the natural resources. It provides the provinces with the right to involve in the energy matters. This has given birth to the lack of effective coordination and cooperation with in the federation and provinces. Moreover it has also created competition between these two entities (Shah, 2012). One evidence of this is the rift between Sindh government and AEDB on wind energy projects in Sindh. According to the Sindh Board of Investment (2013), the role of AEDB in wind energy is competitive with Sindh government, rather than complementing/supplementing. SBI has demanded a reduce role of AEDB in wind projects in Sindh.

Furthermore another major problem with in the institutional barriers is the lack of central RE energy body, which leads to duplication of R&D efforts. Syed Tahawar Hussain (2010) identifies lack of implementation mechanism and integrated planning as major policy issue. According to him it leads to uncoordinated and parallel efforts, which creates confusion with in the donors.

Umer K Mirza (2009) has identified lack of clear institutional mandates as another significant challenge. According to him the mandates are dubious creating confusion for everyone.

b) Regulatory Barriers:

Another RE policy implementation barrier is the regulatory one. In the context of Pakistan, NEPRA has been given the role of regulation. The institution is not only involved in the generation of licenses but also it has significant role in tariff determination for RE projects (NEPRA, 2013).

This tariff determination has gathered a lot of criticism. For example Wind IPP's has the maximum issue with NEPRA over tariff. According to them NEPRA always determine the wind tariff, which is unacceptable and unworkable for them. Thus the wind IPP's undergo through difficult and cumbersome process for submitting numerous tariff petitions. The main reason for that is that the offered petition is always less than one which is petitioned by the IPP'S. One main example is of green star, which has taken the tariff petitions three times (Hussain, 2010).

Similarly the council of common interests criticized NEPRA for not determining up front tariffs for solar projects in May 2013.According to the critiques, these delays not only impedes the investment in the RE sector rather is a key obstacle in the governments measures to overcome the energy crises (Kiyani, 2013).

Furthermore NEPRA is also under criticism for the delays it creates in generation of licenses to rectify this; NEPRA has further simplified the license procedures and have also cut down the fee for further facilitation (Dawn, 2013).

c) Lack of social awareness and acceptance/information:

Awareness and social programs are vital in promoting the use of RE technologies and RE deployments. But unfortunately the social and awareness program's in Pakistan that can help the population in understanding the benefits of RE usage are very few and ineffective. This cause the major barrier in policy implementation Institutes like Pakistan renewable energy society (PRES), Energy foundation Pakistan, Pakistan domestic Biogas program, RESEARCH, REAP, ECI-ECO conservation initiatives are involved in community and awareness program's but the area they cover is very small. Thus their efforts are not fructified and are ineffective, and the barrier remained unresolved (Ottinger, 2013).

Pakistan needs to understand that RE plays a pivotal role for developing countries. They are significant in achieving the MDG's and improving the standard of living. Following is listed how RE contributes in meeting the MDG's :

- Cutting hunger and poverty- reduce the share of income spent on cooking, heating and cooling, making money available for food and thus reducing poverty.
- Primary education- providing light and heating cooling systems, this can improve the drop out rates because of the facilities.
- Female empowerment and health- reducing time of survival activities and generating income opportunities. Use of RE's improve health by reducing the indoor pollution of cooking.
- Environmental stability- reduced deforestation because of renewable energy usage,

decreased green house gases, restoration of ecosystems.(Flavin & Aeck, 2010).

RE above role is negligent in Pakistan awareness campaigns. Thus the social acceptance in Pakistan for RE is less which is a major hindrance in the widespread adoption of RE in Pakistan. More over since the practical information is limited in terms of maintenance, operation and installation of the RE projects, creating a barrier for communities to explore the RET's (Khattak et all, 2006).

Another social barrier identified by Mirza and others is the acquisition of land. Since the acquisitions of traditional lands require a lot of community confidence thus it can lead to lengthy and cumbersome negotiations (Mirza et all, 2009).

Moreover in this regard another key factor that is significant in Pakistan is the lack of awareness among the implementers of the RE policy. This is due to the fact that the selection of the official members or implementers is not on the qualification basis. Rather political affiliations and influences are the determining factors (Mirza et all, 2009).

d) Political barrier:

Another set of barriers that has a lot of significance is the political one. Conflicting political views and political priorities at times becomes a challenge for RE implementation. This happens not only in the developing countries rather developed countries are also not saved from this. For instance the change of government in Queensland (Australia) in 2012, cut down the major funding to the RE projects (Bymes et all, 2013).However policy makers agree to the point that political barriers are more significant in the developing countries like Pakistan.

Pakistan has more unsteady political environment, resulting in changing political priorities. Thus the RE implementation faces not only challenges, but also results in the slow evolution of the RE sector. Before the formation of AEDB, RE did not gain much attention from the political governments and parties. Few preliminary studies were taken in the 1980's but no significant project was undertaken by the governments till the formation of PCRET and AEDB in 2001 and 2003 respectively. Thus Musharraf's and Zardari tenure laid down the foundation for RE made the environment conducive .But the criticism on them remains that RE implementation did not become the key priority for them. Thus the RE policy 2006, which was to be replaced in 2008, delayed and could not achieved its desired objectives. Though the current government seems promising in the RE implementation and evolution of the sector, still there is time for them and it will show their progress (Mills, 2012).

e) Ineffective capacity and training:

Capacity building and training are the crucial aspects in RE implementation. According to the policy makers, no RE project could be successful, without proper capacity building. Thus for this purpose local partners should be involved. They will play critical role in fostering capacity building and expertise.

Currently Pakistan has non effective and small training programs in various parts of the country but it clearly lacks a skilled force this hampers the RE development (Anonymous, 2012). Syed Tahawar Hussain (2010) identifies that delay in most of the RE projects is due to the lack of experience and non handling of the technical issues.

Local level capacity building and community participation is restricted only to few projects. Since the networking at the local level is insufficient, thus it disables the RE deployment at the local level.

Foundation level R&D activities have also been initiated in various universities but they are equal to the drop in the sea. RE successful implementation requires a robust capacity building and training, which Pakistan clearly lacks. Thus there is a long way to go for the successful implementation (Hamid & Rehman, 2010).

f) Poor infrastructure:

In Pakistan another basic challenge for successful RE policy implementation is the poor infrastructure. Energy infrastructure consists of physical infrastructure, energy transformation, T&D and lastly the storage (UNESCO, 2006). Pakistan lacks the physical infrastructure with respect to RE, as well as it has poor transmission and distribution lines in the potential sites. This leads to non exploitation of the RE resources in these areas .Specially the hydro power availability are in the remote and inaccessible areas, which requires high investment for the transmission lines (Khan et all, 2013).

Till now, no infrastructure planning has been drafted by the government and the issue has also not been addressed by the policy. This hinders the RE policy implementation severely.

Another challenge in this regard is that RET's decentralized in nature, while Pakistan energy system supports the needs of a centralized system. The infrastructure support for decentralized are different than the centralized one. Hence the system must adopt decentralized approach for efficient application of RET's (Mirza et all, 2009).

Lack of a robust market support infrastructure is also another challenge in the context of Pakistan. Market support infrastructure refers to the set of connections between dealers, manufacturers, support technologies etc. Pakistan clearly lacks this network. This lack of market infrastructure poses challenges in the market growth, increases the RE energy project cost and decreases the sustainability (Sahir & Quraishi, 2008).

g) Poor information and technology access:

Limited access to RE technical information is another hurdle in the implementation of the RE policy. In Pakistan limited information with respect to resource assessment is significant, especially the wind and water flow data. According to Arif Allauddin, former director of the AEDB, Pakistan has huge RE potential, it has a policy framework too but the projects are few and far. Considerable reason behind it is the lack of credible resource data .This plays a pivotal role for the developers and the investors (World Bank, 2013). Technical information regarding the technologies is also mostly unknown. Moreover lack of information about energy supply demand coupled with lack of feed back from the pilot projects also poses great challenge. Furthermore Pakistan also lacks manufacturing foundation for the RET's, which pushes the state to import the technology, making the cost higher. Thus the over all technical support environments are not made conducive by the officials. Hence these poses serious challenges and halts the RE deployment. According to the policy makers, technical assistance should take in consideration, the feasibility studies, resource assessment, local company's construction, grid expansion and maintenance, and adoption of mitigation strategies (Mirza et all, 2009).

Pakistan is undoubtedly struggling hard in the energy sector. One of the solutions to get out of this crisis is to rely on the indigenous resources and to build a vigorous RE base. But unfortunately the country is facing challenges in the RE sector too with respect to its policy implementation. These challenges can be summed up under cost and non cost categories. Both are equally important in the context of Pakistan.

Pakistan can incorporate one of the best RE sectors in the world if it utilizes and taps the energy to the fullest. All it needs is a dedicated leadership that is willing to put RE on the priority list. And to adopt a holistic approach to mitigate these barriers and challenges. Strength and courage and dedication is required from the government of Pakistan to bring for its people the best of services from RE.

Looking at the above barriers it can be concluded that the non cost barriers creates greater hurdle than the cost barriers. But Pakistan needs to work vigorously to mitigate both these barriers for efficient RE development. A holistic approach is needed to resolve these issues for RE deployment. It's the right time for Pakistan to harness RE because the energy crises will worse more in the upcoming years, making difficult for the officials to curb it down.

Chapter Five

Conclusion/Suggestions

Pakistan finds itself in the energy trap, caught between the challenges and problems of the energy sector and its possible solutions. Some analysts believe that the circular debt problem is the root cause for all these tribulations (Haider, 2013).But others think, that more than the financial, the problem is of the poor governance and mismanagement from the government side. The problem lies with in the poor T&D system, federal and provincial tensions and furthermore the corruption with in the various energy departments. A third view to the Pakistani energy trap has been given by Michael Kugleman. According to him, all the above reasons are secondary; the primary challenge in the energy sector is the lack of political will and strategy (Kugleman, 2013).

According to various policy makers, one of the solutions to the entire energy problem is the diversification of the energy mix, i-e the inclusion of the indigenous resources. Thus to develop the indigenous resources, that is the renewable energy Pakistan took the initiative in the year 2006 by formulating a renewable energy policy. The policy itself was a good start since liberal incentives were given for the initial start up. But from the very beginning it faced numerous challenges and could not achieve the desired set objectives. The first set back was in the year 2008, when the policy was due to be replaced, by a mid term policy. But due to external and internal challenges that AEDB faced, and due to the Pakistan failed to formulate a new policy. On the other side the energy challenges piled up greater and greater. The demand increased day by day, while the supply remained limited. This pushed the state into more difficulties.

The analysis of the RE policy by different policy makers agree to the point that the ineffectiveness of the RE policy is not due to the problems with in the policy formulation, rather the core of the problem is within the implementation framework. This can be even looked well with the lens of contextual interaction theory (discussed earlier).The number of renewable energy institutions/actors and their motives, information and resources plays a significant role in creating barriers for the efficient implementation of the policy. Furthermore the structural contexts in Pakistan as well as the wider contexts of political, economic, cultural and technological plays another significant part in creating challenges. The various barriers with in the implementation framework can be broadly categorized into two.

- Economic/cost barriers.
- Non economic/non cost barriers.

All the non cost barriers, that are the political barriers, regulatory barriers, institutional barriers, poor infrastructure, poor information and technology access, lack of capacity and training and lastly the lack of social awareness and acceptance.

The economic barriers or the cost barriers can be categorized into the following: lack of competition with the conventional power systems, lack of finances, market barriers and others.

Both the categories are equally important in the implementation phase. In Pakistan for the successful implementation of the RE policy the removal of the barriers is significant. Several significant measures can be used for mitigation.

One of the immediate solutions for RE is to adopt an integrated and focused approach. This could be only achieved by strengthening the PCRET and AEDB, in the context of financial

as well as legal mandates. Moreover establishment of a separate renewable energy ministry just like India and other countries can also be helpful. This will not only improve the R&D in renewable sector but can also help in improving the coordination and cooperation factor between the federation and the provinces. Not only integrated efforts will be promoted rather governmental priority of promoting RE will also be increased (Mir, 2013).

Since Pakistan neighbors, the SAARC countries are much ahead than Pakistan in the RE equation. Thus it can not only cooperate with these states, but also can replicate their best practices. With respect to the solar energy program, Bangladesh is the best example for Pakistan. Bangladesh rural development is powered by its solar energy program. IDCOL Bangladesh's finance company with its thirty local partners are selling, installing and maintaining the solar systems in the rural areas. A fifty watt solar home system is enough for four to five energy bulbs, a mobile socket and a radio/TV socket .The total cost on the solar home is less than 250 euros. The unique feature of this program is that these local partners are permanently present in the rural areas and provide micro loans for these systems. Permanent presence facilitate the maintenance of these installed RE systems. Moreover for very poor, even smaller solar systems are available too. These unique features are missing in most of the countries. If incorporated theses features in Pakistan it would be helpful in rural development as well as in raising their standards of living (GIZ, 2012).

Pakistan can take a huge advantage from India as well with respect to its renewable energy practices. Its total share in the overall energy mix is 13 percent. India is known for its wind energy program, which is fifth in the world after China, USA, Germany and Spain. Wind energy in India contributes about 17353 mw in the total energy mix. Thus Pakistan can find

ways for cooperation with India Similarly the solar program of India is gaining momentum as the time passes by. The catalyst for the solar program in India is the Jawaharlal Nehru national solar mission launched in 2009.in a very less span of time its solar program is boosting largely. Pakistan can learn lessons and can incorporate into its own scenario (Bhaskar, 2013).

Pakistan can also replicate Nepal's micro hydel plants. Nepal under the rural development program started the micro hydel program, in fifteen different rural areas. Under the program community organizations were created for community participation for maintenance, management and planning (Pervaiz & Rehman, 2012).

Moreover Pakistan can mitigate RE challenges through cooperation within SAARC. The best platform for this is the SAARC energy centre. It was established in the year 2006 with the aim of boosting cooperation in the energy sector and to bring into reality the Energy Ring Vision. One of the theme programs of the energy centre is renewable energy and energy conservation (Muhammad, 2013). Pakistan needs to identify the various technology options, policy interventions for boosting RE and identifying financial incentives. Pakistan can replicate the success stories in various SAARC countries for its own purpose. It can also take the advantage of the various regional energy experts (Pervaiz, 2013).

Another option for addressing RE policy challenge is to strive for the transfer/reduction of subsidies from conventional to RE. Though it will be a bold step by the government to subsidize solar lanterns instead of kerosene oil but it will benefit the efficient deployment of RE sector, and additionally will decrease the competitive gap between conventional and RE. This concept of subsidy transfers can be better understood by classical supply and demand model. The model represents that after applying subsidies on the RE, the curve

takes a downward shift. While if the subsidies are decreased on the conventional fuels, it takes an upward shift, thus decreasing the gap between RE's and conventional fuels (Yazdanie, 2010).

Another approach for mitigating the gap between conventional and RET's to include externalities. Negative externalities of increased pollution and poor health are linked up with conventional fuels. While positive externalities of reduced pollution and improve health are associated with RE. These externalities will push conventional fuels at a disadvantage as compared to RE (Yazdanie, 2010).

Moreover Pakistan RE equation can be improved by expanding the role of public sector. This will be supportive in Pakistan market expansion. One approach can be: to use RE in the public sector buildings (Mirza et all, 2009). These measures were helpful in Australia and Germany. The later has a large RE installation at various government buildings, while the former used PV's in the Sydney Olympics to accentuate the use of RE's. Moreover public use of RE's will also help in creating public awareness. Pakistan can also make use of its vibrant electronic media for awareness and social acceptance (Yazdanie, 2010).

One of the major steps to overcome the financial barriers is to provide small loans for RE projects. The establishment of various funding organizations can also be helpful in this regard. Furthermore financial incentives should be provided to the manufacturers so that a foundation /base is formed. It will not only reduce the total cost but will further make the environment conducive for RE deployment (Simon et all, 2011).

Pakistan needs to develop a force of skilled people to operate and maintain the RET's. Though several workshops are conducted but the biggest challenge is that they are limited in scope and the area they cover. Pakistan needs to build small permanent training institutes

throughout the country to build capacity. One of the significant features in all these capacity building programs should be the local participation. Another key for success is transparency and trust building. These are the crucial elements in the success of RE's (Anonymous, 2012) Pakistan needs to work vigorously to adopt these measures in its RE sector. Since energy is known to be a significant ingredient in the state's development. It is the life line for growth and development. Through out the world the states are replacing fossil fuels and are incorporating the renewable energy. The shift towards the more efficient technologies is the need of the hour because of the environment friendly nature of these technologies. Another significant reason is the "sustainability factor", as the states are moving towards more sustainable options (Lightfoot, 2008). Thus Pakistan should not lack behind any other state.

References

Abbasi, S. Abbasi, Naseema.(2008).*Renewable energy sources and their environmental impact*. PHI learning pvt ltd.

Asian Development Bank. (2011). "2011 Pakistan Floods; Preliminary Damage and Needs Assessment". Retrieved from http://www.adb.org/

Adnan, Shahzada. Hayat , Azmat . Haider, Sajjad and Mehmood, Rashed . (2012). "Solar Energy Potential in Pakistan", *Journal of Renewable and sustainable energy,volume (4).*

AEDB. (2012). "Pakistan's wind energy program: Wind energy potential in Pakistan". Retrieved from www.aedb.org/

Ahmed. Rashid.(2010).A "Study of geo thermal energy resources of Pakistan for electric power generation". *Energy sources recovery utilization and environmental effects volume (32) issue(9).*

Amjad, Syed . Bilal, Muhammad. Nazir,and Altaf Hussain,(2011). "Biogas renewable energy resource for Pakistan", *Renewable and Sustainable Energy Reviews (15).*

Ali, Imtiaz.(2013). "Sindh wants AEDB role in wind energy reduced". Retrieved from http://www.dawn.com/news/1039893/sindh-wants-aedb-role-in-wind-energy-reduced

AKDN.Retrieved from http://www.akdn.org/AKF

AEDB. Retrieveed from http://www.aedb.org/

AJKHEB.Retrieved from http://www.ajkheb.org/

Dalton, Toby. (2011). "The myth of nuclear energy in Pakistan", *AF Pak Channel*, Retrieved from http://southasia.foreignpolicy.com/posts/2011/05/17/the_myth_of_nuclear_energy_in_pakistan#sthash.1cK6KRn1.dpbs

Dodge, Darrel. (2012). "Illustrated History of Wind power development". Retrieved from http://www.telosnet.com/wind/

EIA projects World Energy Consumption, (2012).Retrieved from http://www.eia.gov/todayinenergy/detail.cfm?id=12251

Environmental problems with coal, oil and gas. (2012).Retrieved from http://www.phyast.pitt.edu/~blc/book/chapter3.html

Environmental protection department. (2007). "Review of the International Energy Policies and Actions and the Environmental Evaluation and Strategic Environmental Assessment." Final report. REF SA 07-003 .

ECORYS. (2010). "Assessment of non cost barriers to renewable energy growth in EU member states AEON".

Enercon.(2006).Retrieved from http://www.enercon.gov.pk/

Flavin, Christopher. Aeck, Molly. (2012). "Energy for development: The potential role of RE in meeting the MDG's". World watch Institute. Retrieved from http://www.worldwatch.org/system/files/ren21-1.pdf

Government of Pakistan. *Energy*. (2013). Retrieved from http://finance.gov.pk/survey/chapters_13/14-Energy.pdf

Government of Pakistan. (2012). "Pakistan Economic survey 2012-13

Government of Pakistan .(1994). "Policy Framework and package of incentives for private sector power generation projects in Pakistan".

"Good bye CNG". (2013). *The Nation*. Retrieved from http://www.nation.com.pk/editorials/10-Oct-2013/goodbye-cng

Government of Pakistan. (2012). "Pakistan energy book 2012"

Government of Pakistan. (2005). "Policy for Development of RE for power conservation"

Government of Pakistan. (1995). "Policy Framework and package of incentives for private sector hydel power generation projects"

Government of Pakistan.(1998). "Policy for new private independent power projects"

Government of Pakistan.(1992)."Pakistan national conservation strategy" Retrieved from http://www.iucn.pk/ncs.htm

Government of Pakistan. (2013). "National Power Policy".

Government plans 2-500mw from wind energy by end of 2015. (2013).*The Nation.* Retrieved from http://www.nation.com.pk/pakistan-news-newspaper-daily-english online/business/08-Jul-2013/govt-plans-2-500mw-from-wind-energy-by-end-of-2015

Government of Pakistan. (2006)."Livestock census".

Government of Pakistan. (2006). "Policy for development of renewable energy for power generation".

Government of Pakistan. (2011)."Alternative and renewable energy policy"

Government of Pakistan.(2011). Pakistan Economic Survey 2011-12.

Geothermal energy. (2012).Retrieved from http://www.renewableenergyworld.com/rea/tech/geothermal-energy

GIZ. (2012). "Rural Development powered by Bangladesh Solar Energy Program", *sustainable energy for development.*

Holm, Deiter.Arch, D.(2005)."Renewable energy: Future for the developing world". *International Solar Energy Society.*

Haider, Mehtab.(2013). "IMF worried as circular debt rises to Rs160 bn again".Retrieved from http://www.thenews.com.pk/Todays-News-13-26503-IMF-worried-as-circular-debt-rises-to-Rs160-bn-again

Harnessing wind power. (2013). *Dawn.*Retrieved from http://dawn.com/news/776823/harnessing-wind-power

"Harnessing the ocean to produce electricity". (2012). *The Express Tribune.*http://tribune.com.pk/story/438149/harnessing-the-ocean-to-produce-electricity/

Hussain, Tahawar.(2012)."Barriers in renewable energy deployment in Pakistan", Paper no 268.Retrieved from http://www.nepra.org.pk/

Haq, Riaz.(2008). *Renewable Energy to Tackle Pakistan's Energy Crisis.* Retrieved from http://www.riazhaq.com/2008/09/tackling-pakistans-electricity-crisis.html

Haider, Mehtab.(2013)."IMF worried as circular debt rises to Rs160 bn again", *Dawn.* Retrieved from http://www.thenews.com.pk/Todays-News-13-26503-IMF-worried-as-circular-debt-rises-to-Rs160-bn-again

Hamid, Bilal.Rehman, Atique.(2010). "The face of renewable energy in Pakistan".

Mir, Hamid.(2013)."Energy crises and its solution".

International Energy Agency. (2012). *World Energy Outlook.* IEA publications Retrieved from http://www.iea.org/publications/freepublications/publication/English.pdf

Iqbal, Zafar.(2010)."Renewable energy report", *Asia and pacific centre for transfer of technology and UN.ESCAP.*

Ilyas, Zafar. (2006). "Biogas support program is a reason for its success in Pakistan", *American Eurasian journal of scientific research volume 1 no (1)*

Jackson,Tim.(2000)."Renewable energy resources", centre for environmental strategy, University of Surrey.

Konrad-Adenauer-Stiftung and East West Institute.(2007). "Renewable Energy: potential and benefits for developing countries". Proceedings of a conference organized by KAS and EWI .

Khan,Badshah. Haq I and Hussain.F.(2013). "Measures for reducing transmission and distribution losses of Pakistan". *International Journal of Scientific and Engineering Research, Volume 4, Issue (4)*

Khattak, Nowsherwan . Hassnain, Riaz. Shah, Waqar . Mutlib, Abdul.(2006). "Identification and Removal of Barriers for Renewable Energy Technologies in Pakistan." *2nd International Conference on Emerging Technologies.* Peshawar: IEEE-ICET.

Kiyani, Khaleeq.(2013). "Alternative-power-sources-nepra-asked-to-finalise-upfront-tariffs", *Dawn*.Retrieved from http://www.dawn.com/news/776389/alternative-power-sources-nepra-asked-to-finalise-upfront-tariffs

Feuling Pakistan. (2013). "LPG an emerging market", Retrieved from http://www.fuellingpakistan.com/index.php?option=com_content&task=view&id=14&Itemid=56

Lightfoot, Douglas.(2008). "Energy Sustainability", *International Conference on Energy for sustainable development.*

Mirza, Umar. Ahmed, Nasir, Harijan, Khanji and Majeed, Tariq.(2009). "Identifying and addressing barriers to renewable energy development in Pakistan" *.renewable and sustainable energy reviews volume 13,issue (4)*

Müller, Simon. Brown, Adam and Ölz, Samantha. (2011). "Policy considerations for deploying renewables".*International Energy Agency.*

Mian, Zia. Nayyer, Abdul.(2009). "Pakistan and the energy Challenge", *International perspectives of energy policy and the role of nuclear power*. Multi science Publishers.

Munir, Kamal and Khalid, Salman.(2012). "Pakistan power crises, How did we get here", *The Lahore Journal of Economics.issue (5).*

Malkani, Sadiq.(2012). "A review of coal and water resources in Pakistan". *Sci., Tech. and Dev.*, 31 (3).

Michael Kugleman,(2013). "Pakistan Energy Crises: From conundrum to catastrophe", *The National bureau of Asian research*, Retrieved from http://www.nbr.org/research/activity.aspx?id=323#.UqlwefkpcpQ

Mills, Elizabeth.(2012). "Pakistan energy crises", *United States Institute of Peace.* Retrieved from http://www.usip.org/sites/default/files/PW79_Pakistans_Energy_Crisis.pdf

MH, Sahira. AH, Qureshi.(2008)."Assessment of new and renewable energy resources potential and identification of barriers to their significant utilization in Pakistan". *Renewable and Sustainable Energy Reviews .*

MS, Hasanain . MB, Gibbs.(1990)."Prospects for harnessing renewable energy sources in Pakistan". *Sol Wind Technol.*

Mohsin, Baqaul . Hameed, Afzaal.(2013). "Solar Park to attract 200b investment", *The Nation*, Retrieved from http://www.nation.com.pk/pakistan-news-newspaper-daily-english- online/national/13-Oct-2013/solar-park-to-attract-rs200b-investment

Mirza,Irfan.,Ahmed, Sana and Khalil, Shahid.(2012). "Wind Energy in Pakistan opportunities and challenges", *international journal of advanced renewable energy research volume 1, issue (4)*

Mitchell. Catherine and Swain, Janet.(2010).*Policy, Financing and Implementation*, USA: Teri publishers.

Mapping the energy revolution,(2013).Retrieved from http://www.worldbank.org/en/news/feature/2013/06/17/mapping-the-energy- revolution

New Bong Escape Hydro power, (2013).Retrieved from http://www.adb.org/projects/38928-014/main

Nawaz Khan, Ameer. Begum, Toheeda and Sher, Mehwish.(2013). "Energy Crises in Pakistan, causes and consequences", *Abasyn Journal of Social Sciences, Vol 4 No(2)*

Naeem, Waqas.(2013)."UNIDO promotes biomass gasification in Pakistan", *The Express Tribune*. Retrieved from http://tribune.com.pk/story/610390/unido-promotes-biomass-gasification-in-pakistan/

National Institute of Oceanography.(2012). "Feasibility Studies for The extraction Of Energy from Current and Halio Hydro Gravity along Pakistan Coast". Retrieved from http://www.niopk.gov.pk/

NEPRA introduces measures to boost renewable energy .(2013). *Dawn*.http://www.dawn.com/news/828944/nepra-introduces-measures-to-boost-renewable-energy

Ottinger, Richard.(2013). *Renewable energy law and development: case study analysis*, UK: Edward Elgar Publishing.

"Objectives and goals of Ministry of water and power".Retrieved from http://www.mowp.gov.pk/

"Objectives and goals of Ministry of petroleum and mineral resources" Retrieved from http://www.mpnr.gov.pk/

"Objectives and goals of hydro carbon institute of Pakistan" Retrieved from http://www.hdip.com.pk/

"Objectives and goals of of alternate energy development board".Retrieved from http://www.aedb.org/

"Objectives and goals of PPIB".Retrieved from http://www.ppib.gov.pk/

"Objectives and goals of WAPDA".Retrieved from http://www.wapda.gov.pk/

"Objectives and goals of PAEC".Retrieved from http://www.paec.gov.pk/

"OGRA"Retrieved from http://www.ogra.org.pk

Organization for Economic Cooperation and Development and International Energy Agency.(2011). *OECD Green growth studies: energy.* OECD publishing.Retrieved from http://www.oecd.org/greengrowth/greeningenergy/49157219.pdf

Ölz, Samantha and Beerepoot, Milou.(2010). "Deploying renewable in South East Asia Trends and potentials", *International Energy Agency.*

Peimani, Hooman .(2011).*The challenge of energy security in the twenty first century, trend of significance,* Singapore: SEAS publishers.

"Pakistan Population growth". Retrieved from http://www.indexmundi.com/pakistan/population_growth_rate.html

"Policy analysis, formulation, and development of policy instruments for promoting renewable energy technology transfer and adoption".(2012).Manilla Philippines.

Pervaz, Muhammad and Rahman, Lutfar.(2012). "Review and Evaluation of Successful and Unsuccessful Renewable Energy Projects in South Asia", *2012 International Conference on Life Science and Engineering IPCBEE vol.(45)*

Pakistan PM announces energy policy to tackle energy crises, April 2010. http://news.bbc.co.uk/2/hi/south_asia/8637454.stm

Planning Commission of Pakistan, "The causes and Impacts of power sector circular debt in Pakistan", March 2013. http://www.pc.gov.pk/hot%20links/2013/Final_USAIDPakistan%20Circular%20Debt%20Report

PCRET http://www.pcret.gov.pk/

Rahman, Fazl."The role of AKRSP in rural development in Karakorm,Hindukush and Himalayan region, examples from northern mountainous belt of Pakistan" *Journal of mountain science volume 4 no 4* .2007.

Pervaiz, Muhammad. "The energy cooperation in south Asia under SAARC umbrella", *6th Japan SAARC symposium*, 2013.

Pakistan Energy Outlook 2012-2026. http://www.pip.org.pk/tickerpopup.php?id=100004

Pakistan Petroleum Limited, "Annual report 2012".Retrieved from http://www.ppl.com.pk/

Rana, Imran. (2013). "Renewable energy German firm to set up first solar panel plant in Pakistan". *The Express Tribune*. Retrieved from http://tribune.com.pk/story/491194/renewable-energy-german-firm-to-set-up-first-solar-panel-plant-in-pakistan/

World watch Institute,(2010). "Renewable energy and energy efficiency in China: current status and prospects for 2020". Report no 182.Retrieved from http://www.worldwatch.org/bookstore/publication/worldwatch-report-182-renewable-energy-and-energy-efficiency-china-current-sta

Raza, Hilal. (2010). "Development of CNG industry in Pakistan", *Hydro Carbon Development Institute of Pakistan.*

Rahman,Khalid.(2010). "Pakistan's Energy Security Challenge: Some Observations and Thoughts", *The Pakistan Development Review, Vol. 47, No. (4).*

Randolph, John. Masters, Gilbert. (2008). *Energy for sustainability, Technology, planning and policy* Island press.

REAP.(2012),Retrieved from http://www.reap.org.pk/

Simon, Christopher.(2007).*Alternative energy: political, economic and social feasibility.*USA: Rowman and Littlefield publishers.

Sheikh, Munawar.(2010)."Energy and renewable energy scenario in Pakistan". *Renewable and Sustainable Energy Reviews volume (14)*

Sm,Zachary,and Taylor,Katrina.(2008).*Renewable and Alternate energy resources.* Santa Barbara,California:ABC –Clio,Inc.

"Status and aim of NEPRA".(2012).Rtrieved from http://www.nepra.org.pk/

State Bank of Pakistan. (2012)."Annual report". Retrieved from http://www.sbp.org.pk/reports/annual/arFY12/Energy.pdf

Sheikh, Munawar.(2010). "Energy and renewable energy scenario of Pakistan" .*Renewable and sustainable energy reviews,(14).*

Schiermeier, Quirin. Tollefson, Jeff . Scully, Tony. Witze, Alexandra & Morton, Oliver. (2008)."Energy Alternatives ,Electricity without carbon", *Nature 454, 816-823.*

"SHYDO"Retrieved from http://www.shydo.gov.pk/

Saeed, Rina.(2013). "The untapped blessing of hydropower". Retrieved from http://dawn.com/news/1031357/the-untapped-blessing-of-hydropower.

Sathaye,Jayath.Lucon,Oswaldo, and Rehman,Atiq.(2010).*Renewable energy in the context of sustainable development.*USA.

Shah, Ranna.(2012). "Energy and the eighteenth amendment", *The News*. Retrieved from http://www.thenews.com.pk/Todays-News-9-94524-Energy-and-the-18th-Amendment

Sahir, Mukhtar . Quraishi, Arshad.(2008). "Assessment of new and renewable energy resources,potential and identification of barriers to their significant utilization in Pakistan" *.renewable and sustainable energy reviews,12.*

Pakistan to import LNG fro Qatar. *(2012).The News.*Retrieved from http://www.thenews.com.pk/Todays-News-13-27246-Pakistan-to-import-LNG-from-Qatar-by-Nov-1

Tirmizi, Farooq.(2013). "Transmission and distribution: power theft is the mother of all evil" *The Express Tribune*. Retrieved from http://tribune.com.pk/story/557858/transmission-distribution-power-theft-is-the- mother-of-all-evil/

Triple Bottom Line,(2010). "Sustainable Advocacy: Solar Energy, a feasible altemative for Pakistan".

US Department of State.(1997). "Dollars from sense: the economic benefits of renewable energy". Retrieved from http://www.nrel.gov/docs/legosti/fy97/20505.pdf

United Nations,(2005). "The Energy Challenge for Achieving the Millennium Development Goals", Energy paper.

UK, Mirza. MM, Maroto-Valer. N, Ahmad.(2003). "Status and outlook of solar energy use in Pakistan". *Renewable and Sustainable Energy Reviews.*

UNFCCC.(1998). "Barriers and opportunities related to the transfer of technology". Technical paper on Terms of transfer of technology and know-how. Document ref: FCCC/TP/

UNESCO.(2006). "Policy Issues for ECAP region, enhancing regional cooperation in infrastructural development including that related to disaster management".

Yazdanie, Mashal.(2010). "Renewable energy in Pakistan: policy strengths challenges and path forward".

World Resource Institute,(2010),retrieved from http://www.wri.org/publication

Wengenmayor, Roland and Buhrke, Thomas.(2013).Renewable *Energy: Sustainable Energy Concepts for the Energy Change*. Wiley.

ANNEXTURES

Policy for Development of Renewable Energy for Power Generation

Employing Small Hydro, Wind, and Solar Technologies

Government of Pakistan
2006

Foreword

Pakistan is blessed with abundance of renewable energy potential but so far this potential has not been harnessed except for large hydroelectric projects. The Ministry of Water and Power has now prepared the first ever Renewable Energy Policy of Pakistan, which envisages mainstreaming of renewable energy in the development plans of the country. The policy comprises of threephases: short, medium and long term. The short term policy, which covers the period up to June 2008, lays down very liberal and attractive incentives to attract investment to put Pakistan on the renewable energy map of the world. Based on the experience gained under the short term, the policy for the next phases will be consolidated and elements of competition will be introduced.

Some salient features of this policy are:

i. It invites investment from the private sector for following categories of proposals:

a. Independent power projects, or IPPs (for sale of power to the grid only)

b. Captive cum grid spillover power projects. (i.e., for self-use and sale to utility)

c. Captive power projects (i.e., for self or dedicated use)

d. Isolated grid power projects (i.e., small, stand-alone)

ii. Except for Category (a) above, these projects will not require any LOI, LOS, or IA from the Government.

iii. Electricity purchase by NTDC/CPPA from qualifying renewable energy-based generation projects has been made mandatory.

iv. It permits an investor to generate electricity based on renewable resources at one location and receive an equivalent amount for own use elsewhere on the grid at the investor's own cost of generation plus transmission charges (wheeling).

v. It allows net metering and billing so that a producer can sell surplus electricity at one time and receive electricity from the grid at another time and settle accounts on net basis. This will directly benefit the economics of small scale, dispersed generation and optimize capacity utilization of installed systems.

vi. It delicences and deregulates small scale power production through renewable resources (up to 5 MW for hydro and 1 MW for net metered sales) to reduce the transaction costs for such investments. This will be particularly beneficial for micro,mini and small hydro as well as solar-based electricity production.

vii. It lays down simplified and transparent principles of tariff determination.

These guidelines are in line with the Government's open door policy for inviting private investment into the country. I hope that it will go a long way in strengthening and improving the power supply position of the country and help fuel rapid and environmentally sustainable economic growth.

Liaquat Ali Jatoi
Minister for Water and Power

December, 2006

1. Introduction

With a large population of over 150 million and a rapidly developing economy,Pakistan's energy needs are potentially huge. The country, historically a net energy importer, is confronting serious imminent energy shortages as its economy and population grow while global fossil fuel prices continue theirupwards spiral. Thus, Pakistan needs to initiate a sustained, long-term transition towards greater use of renewable energy (RE)—an indigenous,clean, and abundant resource whose considerable potential the country hasyet to tap meaningfully.The Government of Pakistan (GoP) intends to pursue this objective ofharnessing power from renewable resources with the full participation and collaboration of the private sector. This document sets out policies and strategies to exploit such resources and attract investments in electricity generation projects utilizing hydro (up to 50 MW capacity), wind, and solar power (of all capacities). For hydroelectricity (hydel) projects of capacitygreater than 50 MW, the applicable policies are described in the GoP's *Policyfor Power Generation Projects, 2002.* Additional policy guidelines shall be issued in the future concerning biomass conversion and other RE technologies, as well as for non-power RE applications, as the sector grows and technology advances take place.

2. Power Sector Institutions

The following institutions are of relevance in facilitating electricity generation, transmission, and distribution in Pakistan. The institutional and functional organization of Pakistan's power sector.

2.1 Ministry of Water and Power

The federal Ministry of Water and Power is the GoP's executive arm for all issues relating to electricity generation, transmission and distribution,pricing, regulation, and consumption in the country, and exercises this function through its various line agencies as well as relevant autonomous bodies. It also serves to coordinate and plan the nation's power sector, formulate policy and specific incentives, and liaise with provincial governments on all related issues.

2.2 National Electric Power Regulatory Authority

The National Electric Power Regulatory Authority (NEPRA) was established under an act of the Parliament (*Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997,* also known as the 'NEPRA Act') to function as an independent regulator and ensure a transparent, competitive, commercially-oriented power market in Pakistan.The Authority's main functions include, *inter alia*, issuing licenses for generation, transmission and distribution of electric power; establishing and enforcing standards to ensure quality, safety, and proper accounting of operation and supply of electric power to consumers;approving investment and power acquisition programmes of the utility companies; and determining tariffs for bulk generation and transmission and retail distribution of electric power.

2.3 Alternative Energy Development Board

The Alternative Energy Development Board (AEDB) was established as an autonomous body with the aim of promoting and facilitating the exploitation of renewable energy

resources in Pakistan so as to achievethe GoP's RE deployment targets. The AEDB is tasked withimplementing government policies and plans, developing projects,promoting local manufacturing, creating awareness and facilitating technology transfer, channelling international assistance, and coordinating all associated activities as the national facilitating agency for the development of renewable energy in the country. It has also been designated as a 'one-window' facility for processing RE power generation projects (of all capacity sizes except hydel projects larger than 50 MW; for hydel projects below 50 MW capacity, consultation with and concurrence of the provinces is mandatory).

2.4 Private Power Infrastructure Board

The Private Power and Infrastructure Board (PPIB), which includes representation from each of the four provinces of Pakistan and AJK, acts as a 'one-window' facilitator for conventional private sector power generation projects, including RE hydel projects of more than 50 MW capacity in the country.

2.5 Provincial and AJK Agencies

Provincial and Azad Jammu and Kashmir (AJK) governments support the implementation of renewable energy projects within their geographical jurisdiction, either on their own or in collaboration with the AEDB, such as by expediting and facilitating allocation of land use rights (e.g., for wind farms), permitting, creating awareness of RE use, and removing other impediments which may hinder progress in their development. Irrigation and Power (I&P) Departments exist in each of the four provinces and in AJK, whose prime function is to manage water resources for agriculture and small power generation units of less than 50 MW. In the Northwest Frontier Province (NWFP), the Sarhad Hydro Development Organization (SHYDO), and I&P Departments in the Punjab, Sindh and Balochistan, are the key institutions. In the Northern Areas, the concerned organization is the Water and Power Department, Northern Areas. Each of these departments have a Chief Engineer,Power Cell, who heads the department's technical management capacity with respect to provincial power projects.

2.6 Power Utilities

Electricity utilities in Pakistan comprise nine separately corporatized distribution companies (DISCOs: Lahore, Gujranwala, Faisalabad,Islamabad, Multan, Peshawar, Hyderabad, Quetta, and Tribal Areas)serving different regions of Pakistan and a private integrated company,the Karachi Electric Supply Corporation (KESC), serving the Karachi metropolitan area. In addition, there are four generation companies (GENCOs: Southern, Central, Northern, and Lakhra) and the Water and Power Development Authority (WAPDA) Hydel Wing. Control of power transmission and despatch is allocated to the National Transmission and Dispatch Company (NTDC).

3. Renewable Energy Resources in Pakistan

Resource Potential Status (2006)

- **Hydro** :The total hydroelectric potential in the country has not been fully investigated, but conservatively estimated to be 45,000 MW. This consists of all sizes of hydropower plants,including storage-based and high-head schemes on mountainous streams in the north and low-head, run-of-theriver plants on rivers

and canals in the southern plains.Pakistan has an installed hydroelectric capacity of 5,928 MW of large (>250 MW), 437 MW of medium (>50 MW and <250 MW), and 253 MW of small to micro (<50 MW) plants, mostly in the northern parts of the country. This amounts to 6,608 MW of total capacity, or less than 15% of the identified potential.

- **Wind:** Commercially exploitable wind resources exist in many parts,especially in southern Sindh and coastal Balochistan, with monthly average wind speeds exceeding 7-8 m/s at some sites along the Keti Bandar-Gharo corridor.No commercial wind farms inoperation. Some micro-windturbines pilot tested for community use.

- **Solar:**Photovoltaic (PV) and thermal Much of Pakistan, especially Balochistan, Sindh, and southern Punjab, receives abundant solar irradiation on the order of over 2 MWh/m2 and 3,000 hours of sunshine a year, which is at the highest end of global insolation averages.Negligible use in niche applications. No significant marketing of rooftop PV or household and commercial thermal systems.

- **Biomass**: Rice husk, straw, dung, municipal solid waste, etc. Pakistan's large agricultural and livestock sector produces copious amounts of biomass in the form of crop residues and animal waste, such as rice husk, and dung, Sugar mills in the country use biogases for cogeneration purposes and have recently been allowed to sell surplus power to the grid up to a combined limit of 700 MW. No much of which is currently collected and used outside the commercial economy as unprocessed fuel for cooking and household heating. In addition, municipal solid waste produced by a large urban population is presently openly dumped, which could instead be disposed of in proper landfills or incinerated to produce useable methane gas or electricity. Other significant commercial biomass-based technology is presently employed for energy production/use in the country beyond experimental deployment of biogas digesters, improved cookstoves, and other smallscale end-use applications. Use of biogas digesters in rural households, after a promising start, has stagnated due to withdrawal of external subsidies

4. Strategic Policy Objectives

The four key strategic objectives for developing Pakistan's renewable energy resources include:

4.1 Energy Security

Mainstreaming of renewable energy and greater use of indigenous resources can help diversify Pakistan's energy mix and reduce the country's dependence on any single source, particularly imported fossil fuels, thereby mitigating against supply disruptions and price fluctuation risks. Additional costs and risks relating to fuel stocking, transportation, and temporary substitute arrangements are also irrelevant for RE systems, except for backup purposes.

4.2 Economic Benefits

When properly assessed for their externalities, renewable energy options can become economically competitive with conventional supplies on a least-cost basis. This is particularly true for the more difficult, remote, and underdeveloped areas, where RE can also have the greatest impact and the avoided costs of conventional energy supplies can be significant. RE can thus supplement the pool of national energy supply options in Pakistan, expediting economic empowerment, improving productivity, and enhancing incomegenerating opportunities—especially for currently marginalized segments of the population. Decentralized RE systems can also help reduce energy distribution losses and result in system-wide and national efficiency gains (e.g., as measured by 'energy intensity', or energy use per unit of GDP). A growing renewable energy industry can afford new prospects for employment and business opportunities amongst local manufacturers and service providers.

4.3 Social Equity

Pakistan's present low per-capita consumption of energy can be elevated through greater RE use. Issues relating to social equity—such as equal rights and access for all citizens to modern energy supplies, improved human development indicators, poverty alleviation amongst deprived sections of society, and reduced burden on rural women for biomass fuel collection and use—can also be addressed significantly through widespread renewable energy deployment. RE can thus facilitate social service delivery and help improve the well-being of the country's poorest, who presently have little or no access to modern energy services.

4.4 Environmental Protection

Local environmental and health impacts of unsustainable and inefficient traditional biomass fuels and fossil fuel-powered electricity generation can be largely circumvented through clean, renewable energy alternatives. Similarly, displaced greenhouse gas emissions carry significant global climate change benefits, towards which Pakistan has pledged action under the UN Framework Convention on Climate Change.

5. Policy Goals and Development Strategy

The specific goals of the renewable energy policy regime to be evolved in order to systematically meet these objectives, of which these guidelines are the first step, would be to:i. Increase the deployment of renewable energy technologies (RETs) in Pakistan so that RE provides a higher targeted proportion of the national energy supply mix, i.e., a minimum of 9,700 MW by 2030 as per the Medium Term Development Framework (MTDF), and helps ensure universal access to electricity in all regions of the country.

ii. Provide additional power supplies to help meet increasing nationaldemand.

iii. Introduce investment-friendly incentives, and facilitate renewable energy markets to attract private sector interest in RE projects, help nurture the nascent industry, and gradually lower RE costs and prices through competition in an increasingly deregulated power sector.

iv. Devise measures to support the private sector in mobilizing financing and enabling public sector investment in promotional, demonstrative, and trend setting RE projects.

v. Optimize impact of RE deployment in underdeveloped areas by integrating energy solutions with provision of other social infrastructure,

e.g., educational and medical facilities, clean water supply and sanitation, roads and telecommunications, etc., so as to promote greater social welfare, productivity, trade, and economic well being amongst deprived communities.
vi. Help in broad institutional, technical, and operational capacity building relevant to the renewable energy sector.
vii. Facilitate the establishment of a domestic RET manufacturing base in the country that can help lower costs, improve service, create employment, and enhance local technical skills.

6. Scope of Policy

For the purposes of this policy statement, 'renewable energy' (or RE) includes the following technologies:

- Small hydro of 50 MW or less capacity1
- Solar photovoltaic (PV) and thermal energy for power generation
- Wind power generation.

Other RE power generation technologies—such as those based on municipal waste and landfill methane recovery, anaerobic or pyrolytic biomass gasification, cofiring or cogeneration utilizing agricultural crop residues, biofuels, wave, tidal, geothermal energy, and fuel cells—are also relevant to current and future renewable energy use in Pakistan. However, these are not dealt with in this document.

7. Road Map for Policy Development and Implementation

Renewable energy development in Pakistan is conceived under a phased, evolutionary approach constituting a strategic policy implementation roadmap.The initial short term phase will involve lenient policy measures and incentives in order to attract investment in this relatively new business area,remove existing barriers to project implementation, and 'hand-hold'reasonable-sized pioneering projects through to successful commercial operation. As experience, business confidence, and domestic industrycapacity grows, it is planned that the policy environment will graduate into a more competitive and deregulated RE market environment, with significantly expanded scale of activities envisioned in the medium and long terms.

7.1 Short Term

(Projects achieving financial closure by June 30, 2008)The focus during this phase would be on RE options amenable to immediate commercial development, i.e., where commercially-proven technologies and resources are readily available, such as small hydro,wind, solar, and biomass-based power generation. This phase, whichis embarked upon now, is marked with liberal risk cover and attractive power purchase tariffs so as to enable a reasonable generation capacity to be installed as 'first-of-kind' RE projects in the private sector that can serve as successful business and technology-assimilation demonstrators. Work on developing an appropriate regulatory framework, development, market and resource assessment, rural energy programme design, pilot testing of dispersed generation systems, capacity building, and development of RE financing and market facilitation measures, will also be undertaken during this period.

7.2 Medium Term

(Projects achieving financial closure during period July 1, 2008 to June 30, 2012)Based on past international and short term domestic RE policy experience, a more comprehensive 'medium term' policy framework will be prepared for the systematic implementation of RE technologies and scaling up of capacity deployment. The framework would lay greater emphasis on competition within an RET application category (e.g., gridconnected wind farms) as well as the programmatic development of dispersed RE power generation market (e.g., solar home systems), and would contain more competitive terms and reduced subsidy and risk cover as compared to the very liberal incentives and guarantees being offered for the short term period.

7.3 Long Term

(Projects achieving financial closure after June 30, 2012) RE will be fully mainstreamed and integrated within the nation's energy planning process. RE energy producers will be gradually exposed to full competition from alternative sources—initially from other RETs and then gradually from conventional sources as well—based on full-price, avoided cost accounting. Third phase RE IPPs will thus ultimately operate under 'mandatory wholesale wheeling', with utilities free to choose between all available supply options competing against each other on an equal footing (i.e., without discriminatory biases, hidden subsidies, and discounted externalities) and with energy prices reflective of actual technology costs and benefits. RE use at the rural and urban household level will become widespread, served by an established local manufacturing and service base.

8. Short Term RE Power Generation Policy

The policy for the short term (up to June 30, 2008) shall be as follows:

Public Sector: A portfolio, consisting of projects situated in far flung areas or that are otherwise not likely to be profitable to the private sector in the foreseeable future, will be identified. These will essentially comprise of sites that are remote, inaccessible, or represent areas characterized by uneconomic levels of power demand, primarily in Balochistan, Sindh, NWFP,FATA, AJK, and the Northern Areas. Such projects would be undertaken through public sector financing and/or through community/NGO/donor participation (e.g., micro and mini hydroelectric projects in the Northern Areas and AJK and village electrification through solar and wind energy in Balochistan and Sindh).

Private Sector: The private sector will be encouraged to undertake commercially viable renewable energy-based power generation projects. For this purpose, incentives—in addition to those already being given to large hydel and thermal IPP projects—are being offered, as detailed in subsequent paragraphs below.

8.1 Avenues for Private Sector Participation

The private sector would be welcome to undertake projects falling in any of the following categories:

i. Independent power projects (IPPs) based on new plants (for sale of power to the grid only)

a. Solicited
b. Unsolicited
ii. Captive and grid spillover power projects (i.e., self-use and sale to utility)
iii. Captive power projects (i.e., for self or dedicated use)
iv. Isolated grid power projects (i.e., small, stand-alone)
a. Solicited
b. Unsolicited.

8.2 General Incentives for RE Power Generators
The provisions stated below shall be made available to all qualifying renewable energy-based power projects following under any of the categories defined in **Section 8.1** above.

8.2.1 Guaranteed Market: Mandatory Purchase of Electricity
It shall be mandatory for the power distribution utilities to buy all the electricity offered to them by RE projects established in accordance with the provisions.

8.2.2 Grid Connection, Off-take Voltage and Interface
Electricity shall be purchased from RE power producers at a voltage of 220 kV at the outgoing bus bar of the power station if the power station is located within 70 km of an existing 220 kV transmission line, or at 132 kV if it is within 50 km of an existing 132 kV transmission line, or at 11 kV if it is within 5 km of an existing 11 kV transmission line, or at 400 V if it is within 1 km of a 400 V distribution feeder. The minimum average power to be supplied in each case would be 1,250 kW/km,250 kW/km, 100 kW/km, and 20 kW/km, respectively. The producer may also undertake to lay a new transmission line for connection with the main electricity grid. The power purchase tariff determination will be
adjusted accordingly for each of these options.

8.2.3 Wheeling
RE power producers shall also be allowed to enter into direct (bilateral) sales contracts with end-use customers. Under this arrangement, they would be allowed to sell all or a part of the power generated by them to their direct customers, and the rest to the utility for general distribution.For direct sales, they shall be required to pay 'wheeling' charges for the use of the transmission and/or distribution grid network used to transport the power from the plant to the purchaser. In practical terms,the IPP shall inject electricity into the grid system at one point (subjectto the provisions in **Section 8.2.2**) and would be entitled to receive thesame amount at any other location (within the same distance from the grid as the distance of the plant from the system) upon payment of a corresponding wheeling charge, to be determined by NEPRA. This wheeling charge will reflect the cost of providing and maintaining the transmission interconnection, including the energy losses suffered *en route*, calculated on a utility-wide basis by NEPRA.

8.3 Specific Incentives for Grid-Connected RE IPPs
Specific incentives are provided under this policy to renewable energybased
independent power producers (IPPs) selling all generated electricity (minus auxiliary consumption) to the grid. The underlying principle is that IPPs based on variable RE

resources (such as wind and water flows) shall be made immune to factors which are beyond their control, and at the same time shall be rewarded if they perform better than reasonably expected.

8.3.1 RE Resource Variability Risk

In the case of grid-connected RE IPPs, the risk of variability in wind speeds (for wind power projects) and water flows (for small hydropower projects) shall be borne by the power purchaser in the manner described in the RET-specific polices. 'Benchmark' electricity production levels based on mean availability of wind or water flow for the month shall be determined for each project location on the basis of independently monitored data. The IPP shall be ensured revenues corresponding to this benchmark level, including potential loss of corresponding carbon credits (see below), even if the resource availability temporarily falls below this benchmark, provided that the reduced electricity production is not due to fault of the IPP itself.

8.3.2 Production Incentives

For all power produced above than the benchmark level, a production bonus payment shall be made to the IPP, as detailed for wind and hydel generation.

8.3.3 Carbon Credits

All qualifying RE power projects (initially wind and small hydro IPPs) eligible for financing under the Clean Development Mechanism (CDM) shall be encouraged to register for Certified Emission Reduction (CER) credits with the CDM Executive Board, either collectively or individually.The Government shall also strive, in collaboration with international development agencies and to the extent possible, to facilitate project applications for such carbon credits in order to reduce the associated initial transaction costs for project sponsors. Importantly, as this policy creates significant incremental costs for the RE power purchaser (higher tariffs, resource availability risks, backup power provision,transmission and interconnection infrastructure, etc.), it is appropriate that any carbon credits thus obtained by RE IPPs be utilized to partly offset this burden so as to improve the economic competitiveness of RE-based grid power for both the rate payers and the producers.The IPP shall therefore, at the time of submission of tariff petition to NEPRA, incorporate the CER-based revenue stream expected over the term of the project's Power Purchase Agreement (PPA), i.e., during and beyond the Kyoto Protocol's Initial Commitment Period (2008-2012), the project's financial analysis on terms specified by the regulator (e.g.,anticipated emissions offset and price per equivalent tonne of CO2 abated), whether opting for up-front tariff or negotiated tariff. A mechanism and legalized institutional arrangement shall be specified by the AEDB and approved by NEPRA, comprising of potential primary beneficiaries (i.e., power producers and purchasers) jointly managing and selling the CERs thus obtained in the international carbon market at an optimum price. The annual carbon revenues realized subsequently shall be divided in the following manner: (a) an up-front, nominal deduction shall be made for the administrative costs of the joint CER management mechanism; (b) an amount not exceeding that required to bring the IPP's return on equity (ROE) to the level allowed by NEPRA shall be payable to the power purchaser; and (c) the remaining revenues shall be divided in equal proportion between the IPP (as a 'green

credit' for enhancing the financial returns accruing to the project's investors) and the power
purchaser (as 'green tariff' support for lowering the per unit price of clean RE power, thereby increasing its attractiveness for purchasers and consumers). Projects shall be required to sign a separate agreement binding them to the terms of such a carbon crediting mechanism, but shall not be penalized for failure to qualify for or obtain sufficient annual CER revenues to fully compensate the power purchaser under Item (b) above, provided they have complied with the terms of the aforementioned carbon credit agreement, as certified byNEPRA.Under this arrangement, the carbon credit sharing mechanism will help further incentivize and facilitate investments in RE projects, increase the share of renewable energy in utilities' power purchase portfolios, and reduce the cost of renewable energy-based power for the end user— factors which should help enhance the eligibility of such projects for CDM approval.

8.3.4 Security Package

The power purchaser shall enter into a specific Power Purchase Agreement (PPA)2, based on a standard model agreement, with the RE power producer. The Government of Pakistan shall also enter into an Implementation Agreement (IA) which will guarantee the payment obligation of the public sector power purchaser on account of power sales extending over the term of the PPA. The PPAs will be much simpler than those for thermal or large hydro IPPs, and shall be based on the purchase of all power generated at a per-kWh rate—i.e., there will be no capacity charge, capacity testing, no risk, and no penalty conditions implied. The Government of Pakistan shall also undertake, as described in **Section 8.3.3** above, to facilitate the acquisition of CDM Certified Emissions Reduction units (CERs) by qualifying projects, and the sharing of associated revenues under a separate agreement and based on payment-on-delivery terms, subject to verification of the same, between the RE IPP (as a 'green' credit) and the RE power purchaser (as 'green tariff' support).

8.4 Facilities for Captive and Grid Spillover Projects

For other categories of RE power generators, e.g., captive and grid spillover power projects, wishing to sell surplus power to the utility grid the, the following facilities shall be made available. These will be further refined and expanded for the next policy phase beginning in 2008 based on initial experience gained in the short term.

8.4.1 Net Purchase and Sales

An RE power project of capacity greater than 1 MW set up for self (captive) or dedicated use may supply surplus electricity to the power utility (grid spillover), while at other times drawing electricity from the utility to supplement its own production for local use, subject to the provisions in **Section 8.2.2**. In such cases, the net electricity a. supplied by the power producer to the utility in a month (i.e., units supplied by the producer minus units received by the producer, if greater than zero), shall be paid for by the utility at a tariff equal to the average energy cost per kWh for oil-based power generation
(as determined by NEPRA for GENCOs/IPPs over the applicable quarter of the year) less 10%, or b. supplied by the utility to the power producer in a month, (i.e., units

received by the producer minus units supplied by the producer, if greater than zero), shall be paid for by the producer at the applicable retail tariff (e.g., industrial or commercial rates,depending upon the type of user connection).Such *net purchase and sales*—or net billing —arrangements will involve measurement of the electricity received and supplied to the utility by the power producer using two separate sets of unidirectional meters.

8.4.2 Net Metering

An RE power project of capacity up to 1 MW set up for self (captive) or dedicated use may also supply surplus electricity to the power utility while at other times drawing electricity from the utility to supplement its own production for local use subject to provision in **Section 8.2.2**. In such cases, the net electricity a. supplied by the power producer to the utility in a month, i.e., units supplied by the producer minus units received by the producer, if greater than zero, or b. supplied by the utility to the power producer in a month, i.e., units received by the producer minus units supplied by the producer, if greater than zero,shall be paid for by the utility or the producer, respectively, at the applicable retail tariff (e.g., industrial, commercial, or residential rates). Such *net metering* arrangements may involve separate sets of unidirectional meters for recording the electricity received and supplied to the utility by the power producer, or special bidirectional meters capable of instantaneously recording net power transfers. This facility would be particularly suitable for incentivizing dispersed small-scale RE generation, such as rooftop PV panels, helping optimize their utilization and payback rates and obviating the need for expensive on-site storage batteries.

8.4.3 Banking

For net billing purposes, a rolling account of energy units will be maintained on the pattern of a bank account (i.e., debit or credit basis).Such banking accounts of net energy units shall be maintained on a monthly basis and final balances will be reconciled at the end of the year at the rates given in **Section 8.4.1**. Under this arrangement, a producer may generate and supply power to the grid at one location and receive an equivalent number of units for self use (say, at a factory) at a different or physically distant location on the grid at a different time *without paying any wheeling charges,* but subject to the distance limits for power input and off take as noted in **Section 8.2.2**. Any additional (net) units consumed by the producer (beyond those supplied to the utility at the plant location) in a given month shall be billed by the utility at the retail tariff applicable to the type of electricity connection obtaining at the consumer's premises. Any excess (net) units supplied by the producer's plant in a given month shall be credited to the producer on a rolling monthly basis (i.e., deducted from the next month's consumption). Any accumulated energy unit credits accruing to the producer at the end of the year shall be paid for by the utility at a tariff equal to the average energy cost per kWh for oil-based power generation (as determined by NEPRA for GENCOs/IPPs over thepreceding fiscal year) less 10%.

8.5 Facilities for Off-grid and Dispersed RE Power Generation

Off-grid power generation wholly for captive or dedicated use—or for supply to a local community through small, isolated distribution lines not connected to the utility grid—shall be greatly deregulated and simplified. For this purpose, new procedural

arrangements shall be developed by the relevant AEDB/Provincial/AJK Agency, and these shall be reviewed and further refined for the medium term based on initial implementation results.Small hydropower projects and associated distribution grids (of up to 11 kV) that are not connected to national or regional utility grids may be developed by private corporate entities, public agencies, NGOs and CBOs, or individuals at any suitable location, subject to prior approval by the local authority. For such projects, AEDB/Provincial/AJK Agency approval, or Environmental Protection Agency (EPA) NOCs shall not be required, provided minimum permitting requirements, as defined, are met. For these projects, the AEDB/Provincial/AJK Agency and EPA shall develop a simplified regime separately along the lines specified During the short term (2006-08), the emphasis shall also be on the design, demonstration, and testing of dispersed off-grid, community,embedded, and standalone RE systems, including their financing and marketing modalities and integration with other social and physical infrastructure development (e.g., poverty alleviation, rural electrification, etc.). Extensive, widespread funding and deployment will be targeted, based on such initial studies and field evaluation, for the medium term (2008-2012), with specific RET- and market-wise targets and financing arrangements to be in place starting at the onset of that period.

8.6 Financial and Fiscal Incentives

All renewable energy-based power projects will enjoy the following fiscal and financial incentives. These facilities shall be equally applicable to private, public-private, and public sector renewable energy power projects.

8.6.1 Fiscal Incentives

i. No customs duty or sale tax for machinery equipment and spares (including construction machinery, equipment, and specialized vehicles imported on temporary basis) meant for the initial installation or for balancing, modernization, maintenance, replacement, or expansion after commissioning of projects for power generation utilizing renewable energy resources (specifically, small hydro, wind, and solar).Exemption from income tax, including turnover rate tax and withholding tax on imports.Repatriation of equity along with dividends freely allowed, subject to rules and regulations prescribed by the State Bank of Pakistan.Parties may raise local and foreign finance in accordance with regulations applicable to industry in general. GoP approval may be required in accordance with such regulations.Non-Muslims and non-residents shall be exempted from payment of *Zakat* on dividends paid by the company.

8.6.2 Financial Incentives

i. Permission for power generation companies to issue corporate registered bonds.
ii. Permission to issue shares at discounted prices to enable venture capitalists to be provided higher rates of return proportionate to the risk.
iii. Permission for foreign banks to underwrite the issue of shares and bonds by private power companies (IPPs) to the extent allowed under the laws of Pakistan.
iv. Non-residents allowed to purchase securities issued by Pakistani companies without the State Bank of Pakistan's permission, subject to prescribed rules and regulations.
v. Independent rating agencies available in Pakistan to facilitate investors in making informed decisions about the risk and profitability of the project company's bonds/TFCs.

8.7 Procedure for Setting Up RE IPPs for Sale of All Power to Grid

The following categories of proposals for RE-based IPP projects shall be welcomed by the AEDB and designated provincial/AJK agencies.

i. Unsolicited proposals

ii. Solicited proposals

In the case of unsolicited proposals, a Letter of Intent (LoI) shall be issued to enable the sponsors to carry out a feasibility study and obtain tariff determination and a generation license from NEPRA. Thereafter, a Letter of Support (LoS) shall be issued to assist the sponsors in achieving financial closure for the project. In the case of solicited proposals, bids shall be invited by AEDB/Provincial/AJK Agency from IPPs to participate in a competitive bidding process. After completion of evaluation of bids, an LoS shall be issued to the successful bidder to facilitate the project's financial close. The procedure will be structured in consultation with NEPRA. The tariff determined through competition will be regarded as final and will not be re-opened by NEPRA.These processes are described in detail below:

8.7.1 Process for Unsolicited Proposals

Potential sponsors of RE-based IPP projects to be connected to the utility grid at a location of their choice ('raw site'), subject to the provisions in **Section 8.2.2**, may submit their proposals to the AEDB/Provincial/AJK Agency on an unsolicited basis. The schedule of activities leading to issuance of Letter of Intent (LoI) and/or Letter of Support (LoS) and is explained further in subsequent paragraphs.

8.7.1.1 Submission of Unsolicited Proposals

Any sponsor wishing to undertake a project at a raw site would be required to submit a detailed proposal to the AEDB/Provincial/AJK Agency, which must be in compliance with applicable policy guidelines and include, at a minimum,
the following:

i. Statement of qualification of project sponsors, listing relevant corporate experience, personnel, and financial capacity

ii. Project name and RET classification (i.e., wind, solar,small hydro, etc.)

iii. Project location (including geographical or GPS coordinates)

iv. Proposed net installed capacity (MW) and expected annual energy output (MWh)

v. Basic outline of plant and structures

vi. Summary implementation plan, committing milestones for project preparation, implementation and completion date.

vii. Estimated distance from the nearest 132 kV or 11 kV line or grid station.

8.7.1.2 Evaluation of Unsolicited Proposals and Issuance of Letter of Intent

Proposals for unsolicited projects on raw sites5 will be examined by a Project Committee appointed by the AEDB or Provincial/AJK governments. Proposals approved by the Committee will be processed by the AEDB/Provincial/AJK Agency for issuance of a Letter of Intent (LoI) against a Bank Guarantee . This Bank Guarantee shall be valid for a period not less than six (6) months in excess of the validity of the LoI, following which the provisions of the agreements shall be applicable. LoIs for raw sites shall include relevant project milestones to enable the AEDB/Provincial/AJK Agency to monitor progress, and the sponsors shall commit to meeting the milestones stipulated therein.

8.7.1.3 Feasibility Study

The sponsors shall enjoy exclusive rights to carry out a feasibility study at a given site during the period of the LoI, as long as they continue to meet the milestones specified in the latter.The feasibility study will be reviewed by a 'Panel of Experts'(POE) appointed by the AEDB/Provincial/AJK Agency. If at any time during the feasibility study period, the POE determines that the sponsors have failed to adhere to relevant milestones or rectify such deviation, or are not diligent, the AEDB/Provincial/AJK Agency may serve a notice to the IPP to rectify the situation, failing which it shall terminate the LoI and encash the Bank Guarantee. In such a case, the sponsors will have no claim for compensation against the any federal/provincial/AJK agency. Feasibility studies undertaken by the public sector and donor agencies will be made available to all interested private

entrepreneurs by the AEDB/Provincial/AJK Agency against a nominal administrative fee. The full cost of the feasibility study (up to a reasonable ceiling and as reflected on the books of the concerned agency as being the actual cost of the feasibility study), shall be indicated in the LoI and charged to the project developer at the time of issuance of the Letter of Support (LoS), and shall be reimbursed to the agency which

originally conducted the study, except in the case where such study was conducted under grant financing (e.g., donor funding, etc.). Wherever the GoP has obtained such a

feasibility prepared by the public or private sector, preference would be given to the award of these projects through international competitive bidding (ICB).For studies furnished to the private sector by the AEDB/Provincial/AJK Agency or any public sector organization, investors shall be responsible for verifying any or all aspects of the relevant feasibility study, and would be encouraged to carry out additional or alternative project appraisal of the site on their own for such purposes.In case the feasibility has been completed by the public sector or private sponsor but the unsolicited proposal does not materialize for any reason whatsoever, and the AEDB/Provincial/AJK Agency wishes to invite bids using the same feasibility study, then the cost of feasibility study (up to a reasonable ceiling and as per proper audit) will be recovered from the successful subsequent bidder, if any, and be reimbursed to the public sector entity or sponsor who originally paid for, or conducted, the study.

8.7.1.4 Bank Guarantee and Validity Period of Letter of Intent

For issuance of the LoI, sponsors will be required to post a Bank Guarantee in favour of the AEDB/Provincial/AJK Agency based on the project's estimated installed capacity. This guarantee shall be valid for a period extending six calendar months beyond the original validity of the LoI. The initial validity of the LoI shall be up to 18 calendar months, depending on the size of the project and the schedule committed to by the IPP. A one-time extension to the LoI of up to a maximum period of 180 calendar days may be granted by the relevant AEDB/Provincial/AJK Agency if the Panel of Experts (POE) deems the sponsors' progress on the feasibility study to be otherwise satisfactory and its completion imminent. Submission of a Bank Guarantee valued at twice the original amount (i.e., US$ 1,000/MW) and valid for six calendar months beyond the extended LoI period will be mandatory to qualify for an LoI extension.If during the currency of the LoI, a sponsor wishes to withdraw from the project, the extent to which the Bank Guarantee amount shall be encashed will be in proportion to the time elapsed since the issuance of the LoI with respect to the total period of the LoI.

8.7.1.5 Request for Determination of Tariff

Upon completion, the feasibility study will be reviewed by the POE, and if approved, the project sponsors will be expected to apply to NEPRA for determination of bulk power purchase tariff and grant of generation license within a period not exceeding three calendar months from the date of said approval. Details of guidelines of determination of tariff are provided . In case the IPP opts to accept the up-front tariff, if already notified by NEPRA, the process of tariff determination would likely be significantly shorter.

8.7.1.6 Performance Guarantee and Letter of Support

Subsequent to determination of the bulk power purchase tariff by NEPRA, the project sponsor shall be required to post aPerformance Guarantee based on project capacity in favour of the relevant AEDB/Provincial/AJK Agency, valid initially for a period of three months in excess of validity of the LoS. Upon submission of the Performance Guarantee, a Letter of Support (LoS) shall be issued to the project sponsor by the relevant AEDB/Provincial/AJK Agency to enable the project to achieve financial close. Until financial close is achieved, the LoS shall govern the project and supersede all other documents and agreements. If the LoS is issued by the provincial/AJK government, the AEDB shall be officially notified of this. Similarly, if the LoS is issued by the AEDB in the provinces or AJK, the relevant provincial/AJK government shall be notified. The AEDB shall maintain a central registry of all approved RE IPPs in the country to ensure their proper coordination and facilitation at the federal level.

8.7.2 Process for Solicited Proposals

Proposals for grid-connected RE power generation projects at preselected sites may be solicited by the AEDB/Provincial/AJK Agency through public advertisement. These may include sites/projects for which feasibility studies have already been completed in the public sector, as well as 'raw sites' not yet fully investigated. Such projects will be processed according to the steps and schedule.For **raw project sites**, the relevant RET, location, and other preliminary information will be made available to investors and Expressions of Interest (EoIs) invited. The bidder ranked highest in the prequalification process shall be awarded an LoI for the corresponding project. The rest of the process for proposal submission and evaluation shall be identical to that described previously for unsolicited proposals, leading to issuance of the LoS. For **sites for which feasibility studies may have been completed** prior to bid solicitation, specific tender documents will be prepared and bids will be invited for the sale price of electricity (against NEPRA'sindicative tariff as a benchmark, using the same parametric formulation to allow for standardized comparison basis). The successful bidder shall be awarded an LoS to help achieve financial close. The schedule of activities leading to issuance of LoS are also given In order to further economize processing time, steps 'a', 'b' and 'c may be eliminated and instead sponsors may be asked,through advertisement, to submit their proposals in two envelopes. The first envelope would be meant for evaluating the bidders' qualifications and the second envelope for the main commercial bid. In such a case,the commercial bids (second envelope) only of qualified bidders will be opened, and the maximum time allowance for activity 'e' may be increased to 100 days.

8.7.2.1 Request for Proposals

The RFP for solicited projects shall contain all project specifications, components, and requisite details necessary for the preparation of a proper technical and commercial bid. The documents will also explain the evaluation criteria to be employed in scoring the

bids.If necessary, a pre-bid conference may be held by the AEDB/Provincial/AJK Agency to facilitate exchange of information with qualified sponsors, giving equal and adequate opportunity to all prospective bidders to seek clarification on project requirements.

8.7.2.2 Bid Bond, Letter of Support, and Performance Guarantee

A Bid Bond based on the project's installed generation capacity shall be required from each bidder at the time of submission of bids. After selection of the successful bidder, the bid bonds of all bidders other than the sponsors of the successful bid shall be returned, and the successful bidder will be required to post a Performance Guarantee based on project capacity in favour of the relevant AEDB/Provincial/AJK Agency for issuance of a Letter of Support (LoS), and which shall be valid initially for a period of three months in excess of validity of the LoS. After submission of the Performance Guarantee by the successful bidder, the Bid Bond shall be returned and the LoS issued to enable the project to achieve financial close. Until financial close is achieved, the LoS shall govern the project and supersede all other documents and agreements.If the LoS is issued by the provincial/AJK government, the AEDB shall be officially notified of this. Similarly, if the LoS is issued by the AEDB in the provinces or AJK, the relevant provincial/AJK government shall be notified. The AEDB shall maintain a central registry of all approved RE IPPs in the country to ensure their proper coordination and facilitation at the federal level.The Performance Guarantee will secure the successful bidder's obligations to execute the IA, PPA, and other relevant agreements and achieve financial closure within the specified time period. In addition, the sponsor may also be required to reimburse the cost of feasibility study utilized (if so indicated in the bidding documents). The Performance Guarantee shall be in the form of an irrevocable, direct-pay letter of credit, issued by a scheduled local or foreign bank acceptable to the Government of Pakistan, in favour of the relevant AEDB/Provincial/AJK Agency. The Performance Guarantee must always remain valid for a period not less than three months in excess of the then prevailing financial close deadline. If the Performance Guarantee is not furnished within the specified period, the LoS shall a lapse automatically, and neither the sponsor nor the project company shall have any claim for compensation or damages against the Government of Pakistan/AJK or any of its components, organizations, provinces, or institutions on this account.

8.7.3 Process Subsequent to Issuance of LoS

After the issuance of the LoS to sponsors of unsolicited or solicited RE IPP projects, the sponsors will be expected to carry out the following activities:

i. Sign the Implementation Agreement (IA) and a Certified Emission Reduction Agreement (CERA), with the AEDB acting on behalf and with the permission of the GoP, and the Power Purchase Agreements (PPA) with the power purchaser.

ii. Achieve financial close (as defined in the IA or PPA)

iii. Achieve construction start (as defined in the IA or PPA)

iv. Execute and commission the project according to major milestones established in the LoS. In case of default or departure from agreed milestones by project sponsors, the AEDB/Provincial/AJK Agency shall have the right to terminate the LoS and encash the sponsors' Performance Guarantee upon issuance of due notice assigning reasons for such action and after provision of sufficient opportunity for the redressal of such default. However, if the delay is caused by actions of the power purchaser or by

the government, then the IPP shall not be penalized. Upon financial close, the security agreements (IA and PPA) will supersede the LoS and all other documents and agreements. If the LoS expires, the IA and PPA and all other agreements with any governmental entity shall automatically terminate.The investor, after receiving the LoS, will be required to submit to the relevant AEDB/Provincial/AJK Agency, on a format specified by the agency, a mutually acceptable implementation schedule with specific milestones for progress monitoring. The AEDB/Provincial/AJK Agency shall execute the project's Implementation Agreement (IA) on behalf of the Government of Pakistan, whereas the Power Purchase Agreement (PPA) will be executed between the IPP and the buyer upon GoP's formal approval.

8.8 Security Package and Risk Cover

The security package for grid-connected RE IPPs will comprise of the following:

i. Implementation Agreement (IA), Power Purchase Agreement (PPA), Certified Emissions Reduction Agreement (CERA), and Water Use Agreement (WUA), as applicable.

ii. GoP guarantee on payment obligations of public sector entities. If some or all of the utilities are restructured or privatized during the term of various agreements, appropriate safeguards shall be built in the privatization agreements so that the IPP contracts are wholly securitized over their respective full terms.

iii. Provide protection against specific 'political' risks.

iv. Provide protection against changes in the tax and duty regime.

v. Ensure convertibility of Pakistani Rupees into US Dollars at the prevailing exchange rate and the remitability of foreign exchange to cover necessary payments related to the project, including debt servicing, payment of dividends, and repatriation of equity.

vi. Specific risk cover against RE resource variability as detailed in

vii. Suitable indexation of tariff components to cover the risk of exchange rate variations and inflation, etc.

8.9 Corporate, Fee, and Contractual Arrangements

8.9.1 Fee Structure

8.9.2 Enterprise Structure and Licensing Requirements Each IPP setting up a plant meant only for supplying power to the utility grid will be required to form a company in accordance with the laws of Pakistan under the Companies Ordinance, 1984, for the specific purpose of power generation and obtain a generation license from NEPRA. However, producers who wish to establish plants which are not exclusively for sale to power utility (e.g., captive or dedicated plants with or without grid spillover provision) may not form such a special purpose company. Small producers of installed capacity less than or equal to 5 MW not connected to the grid (i.e., standalone captive or isolated local distribution) shall not be required to form a special purpose company or obtain a generation licence from NEPRA, but would be required to register with the AEDB/Provincial/AJK Agency and obtain consent from the local administration.

8.9.3 Lock-in Period

The 'Main Sponsor' (defined as the individual or group holding at least 20% equity in the IPP project), together with other initial project shareholders, must hold 51% of the project equity for a period up to the project's Commercial Operations Date (COD).

8.9.4 Type of Contracts

RE IPP projects for sale of all power to the grid system may be implemented through either 'Build, Own, and Operate' (BOO) and 'Build, Own, Operate, and Transfer' (BOOT) contracts between the parties concerned, valid for a period of not less than 20 years.

For the other type of projects, no such contracts shall be required. Instead, for captive, dedicated, or grid spillover projects, or projects availing of 'net billing', 'wheeling' or 'banking' facilities, separate contractual arrangements will be required between the parties dealing with matters such as metering, maintenance of interconnection, system protection, and billing of net sales and purchase, wheeling, and banking charges/tariffs,

8.9.5 Nature of Equipment

Projects which are meant for generating electricity for the sole purpose of supply to the utility (NTDC or DISCOs) grid system, i.e., grid connected RE IPPs, will be required to use new equipment. There shall be no such restriction on other producers.

ALTERNATE AND RENEWABLE ENERGY POLICY 2011

Government of Pakistan
2011

FOREWORD

Nature has blessed Pakistan with enormous renewable energy potential which can be utilized for power generation and to meet energy needs of the country. The Government of Pakistan (GoP) initiated development of Renewable Energy Sector under a phased, evolutionary approach constituting a strategic policy implementation roadmap to increase the deployment of ARE technologies (ARETs) in Pakistan (ARE Policy 2006). ARE promises a higher proportion of the national energy supply mix and helps ensure universal access to electricity in all regions of the country.

The GOP's strategic objectives of Energy Security, Economic Benefits, Social Equity, Environmental Protection, Sustainable Growth and Gender Mainstreaming, now are further harnessed under the ARE Policy 2011, developed by the Ministry of Water and Power with the support of international agencies including Asian Development Bank (ADB), USAID, UNDP, German Technical Corporation (GTZ), Energia International and with consensus of all relevant stakeholder including provincial governments, private sector and academia. The ARE Policy 2011 will help create a conducive environment for the growth of domestic ARE Sector.

Experience under ARE Policy 2006 coupled with international best practices provide the basis for more comprehensive framework for ARE Policy, 2011. It has an expanded scope encompassing all alternative and renewable energy sources, enhanced financial mechanisms and also addresses areas like rural energy services and bio-fuels. It carries forward most of the liberal and attractive incentives of ARE Policy 2006 to maintain the investors' confidence, and places greater emphasis on aggressive growth of grid-connected ARET applications (e.g. wind farms) as well as a programmatic development of dispersed ARE power generation market (e.g. solar home systems) on more competitive terms.

Salient features of the ARE Policy 2011 include variety of investment options for tapping different ARE resources for on-grid and off-grid applications and also encourages consumer based initiatives. Attractive policy instruments supplement GoP's open door initiatives for private investment in ARE sector in Pakistan as it is envisaged to contribute its share in strengthening and improving the power supply position of the country and help fueling rapid and environmentally sustainable economic growth.

March 2011

Syed Naveed Qamar
Minister for Water and Power

CHAPTER 1

INTRODUCTION

1.1 Background

The Policy for Development of Renewable Energy for Power Generation, 2006 (the "**ARE Policy 2006**") introduced Government of Pakistan's (**GOP**) phased program for the development and implementation of Alternative and Renewable Energy (**ARE**) based projects in the country. Initially, GOP introduced strong incentives in order to attract investment, remove barriers to project implementation, and 'hand-hold' pioneering projects through to successful commercial operations. While aiming at achieving certain defined medium-term objectives on the one hand and ensuring continuity on the other, the Policy for Alternative and Renewable Energy, 2011 (the "**ARE Policy 2011**") enumerates the medium-term objectives and provides the roadmap for further realizing the full potential of ARE in Pakistan.

Power generation in Pakistan is sourced through a mix of thermal, hydel and nuclear power plants, with thermal power generation comprising the bulk, followed by hydel and nuclear contributing nominally. Based on relevant international and domestic experience, ARE Policy 2011 provides a comprehensive framework encompassing wider scope for utilization of all ARE sources; not only for the purposes of generation of electricity but also for encouraging recourse and utilization of ARE technology (**ARET**) based applications by commercial and domestic consumers. The measures introduced in the ARE Policy 2011 are expected to set the requisite infrastructure in place so that ARE is fully mainstreamed and integrated within the country's energy planning, economic and social development process for the eventual benefit of the people of Pakistan.

GOP is determined to pursue the stated policy objectives and strategies with the participation and collaboration of the private sector. The goal is to continue the envisaged sustained transition towards greater use of indigenous, clean and abundant ARE resources, which must be tapped in a meaningful and timely fashion and utilized towards the social and economic advancement to assist the country's overall development strategy.

1.2 Legal Framework

Under the prevalent constitutional framework of the country, the Federal Government is envisaged to legislate on the subject of "electricity" whereas, provincial governments have significant role to play in the development of ARE in Pakistan. ARE Policy 2011 is therefore, presenting a coordinated arrangement between GOP and the provinces for the processing of ARE projects in Pakistan.

In early 2011, the Federal Government enacted the Alternative Energy Development Board Act, 2011 (the "**AEDB Act**"), which empowers Alternative Energy Development Board ("**AEDB**") to, *inter alia*, undertake the following responsibilities:

- To develop national strategy, policies and plans for utilization of ARE;
- To evaluate, monitor and certify ARE projects and products;

- To act as the coordinating agency for commercial application of ARET and to interact and coordinate with national and international agencies for the promotion and development of ARE;
- To facilitate power generation through ARE by acting as one-window facility for all investors;
- To set up ARET based power projects on it's own or through joint venture or partnership with public or private entities, and conduct requisite feasibility studies or surveys;
- To assist in the development and implementation of off-grid electrification;
- To make legislative proposals to enforce use and installation of ARET based equipment;
- To provide technical expertise to the Ministry of Environment as the Designated National Authority (**DNA**) in its role under the Clean Development Mechanism (**CDM**).

1.3 Extension of Term of ARE Policy 2006

The ARE Policy 2006 was originally stipulated to be replaced by a longer term policy by June 31, 2008, however the policy was extended and is being replaced by ARE Policy 2011. All existing projects including those which are going to achieve financial close under the ARE Policy 2006 would have the option to be treated under the framework of ARE Policy 2011 or to continue with terms offered under the previous ARE Policy 2006.

CHAPTER II INSTITUTIONAL FRAMEWORK

2.1 Power Sector

The Ministry of Water and Power acts as the executive arm of the GOP in execution of Federal Government policies and strategy in the power sector. It also coordinates with relevant provincial governments and their agencies in achieving national policy objectives.

The National Electric Power Regulatory Authority (**NEPRA**) set up under the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 (known as the "**NEPRA Act**") is the apex regulatory body, which is mandated to act as an independent regulator for the provision of electric power services in Pakistan. The Karachi Electric Supply Corporation (**KESC**) and the eight distribution companies provide distribution services under license from NEPRA. The sole transmission system operator, National Transmission and Dispatch Company (**NTDC**) also licensed by NEPRA transmits power purchased through the Pakistan Power Holding Company Ltd. / Central Power Procurement Agency (**CPPA**) / or any other legislative regime specified by GOP time to time, from GoP owned thermal generation companies (**GENCOs**) and independent power producers (**IPPs**). NTDC is also the System Operator for the secure, safe and reliable operation, control and dispatch of generation facilities as well as the Transmission Network Operator for the operation and maintenance, planning, design and expansion of the national transmission network.

Within the context of ARE Policy 2011, Alternative / Renewable Energy based Independent Power Producers (**ARE-IPPs**) are ARE based power generation companies established for dedicated sale of power under guaranteed agreements with NTDC/CPPA/DISCOs. Likewise, the ARE Distributed Generators (**ARE DGs**) produce power for self use and for sale to bulk consumers/utility under bilateral contract.

Private Power and Infrastructure Board (**PPIB**), is established as a "one window" facilitator for conventional private power sector generation projects, including hydel projects of above 50 MW capacity. AEDB works very closely with PPIB to ensure consistency of policy outlook and implementation; however, each organization has distinct role and responsibilities.

The Provincial Governments of Balochistan, Khyber-Pakhtunkhwa, Punjab and Sindh support the development and implementation of ARE projects within their territories. Similarly, the Northern Areas comprising the Gilgit-Baltistan (**GB**) region and the State of Azad Jammu and Kashmir (**AJK**) support development of RE projects through local departments. Additionally, the Board of AEDB also ensures provincial representation for smooth ARE project implementation.

NR) ensures availability and security of sustainable supply of oil and gas for economic development and strategic requirements of Pakistan. A number of organizations/companies are working under its administrative control notable amongst these are the Hydrocarbon Development Institute of Pakistan (**HDIP**) providing consultancy and laboratory services for the oil and gas industry in diverse fields of its expertise, Oil and Gas Development Company Limited (**ODGCL**) and Pakistan State Oil Company Limited (**PSO**) the two public sector oil and gas exploration and Oil marketing companies, respectively. Oil and Gas Regulatory Authority (**OGRA**) set up under the Oil and Gas Regulatory Authority Ordinance dated 28th March 2002 regulates the midstream and downstream petroleum sector and safeguards public interest by fostering competition, increased private investment and ownership.

Ministry of Food and Agriculture and Livestock (**MinFAL**) is mainly responsible for policy formulation, economic coordination and planning in respect of food grain and agriculture. Main functions of the Ministry include: procurement of food grains, fertilizers; stabilization of import price for agriculture produce; international liaison; economic studies for framing agricultural policies etc. Exhibit 2 illustrates the Institutional organization of Biofuel Programme.

Alternative Fuel Producers (**AFPs**) are those companies established for the purpose of alternative fuel plantation, alternative fuel refining and/or alternative fuel importing in the country.

CHAPTER III SCOPE AND OBJECTIVES

3.1 Effective Date and Scope of ARE Policy 2011

ARE Policy 2011 will become effective from its date of notification. Consistent with the AEDB Act, the ARE 2011 Policy framework includes incentives for all initiatives under the following categories:

- Alternative Fuels
- Renewable Energy
- ARE-Fossil Fuel Hybrid Systems

3.1.1 Alternative Fuel

- Biogas
- Biofuels - including but not limited to ethanol and bio diesel
- Fuel from Waste – including but not limited to refuse derived fuel (RDF), processed agricultural and industrial waste etc.
- Hydrogen

3.1.2 Renewable Energy

- Geothermal
- Hydro – up to 50 MW
- Marine – including Ocean, Wave & Tidal
- Solar – Solar Thermal or Solar PV
- Wind
- Energy from Waste – including but not limited to biomass, municipal solid waste and sewerage

3.1.3 ARE-Fossil Fuel Hybrid

Systems capable of utilizing both conventional fuel and ARE resources having a minimum of seventy percent (70%) share of ARE resource component.

3.2 Resource Potential in Pakistan

Exhibit 3 below provides an indicative summary of the ARE potential in Pakistan.

Exhibit 3: Resource Potential in Pakistan

Resource	Potential
Small Hydro	As per preliminary studies and available data, the potential for small hydro is around *[4,500[1]]* MW.
Wind	Pakistan has total estimated wind power potential of 346,000 MW[2] out of which around 60,000 - 70,000 MW is technically exploitable. The Wind Map of Pakistan indicates major wind corridors in southern Parts of Sindh, North Western parts of Balochistan, Central parts of Khyber Pakhtunkhwa and AJK, with several isolated wind corridors in central and western Punjab, Central and Southern Balochistan and Gilgit Baltistan areas.
Solar: Photovoltaic (PV) and thermal	Pakistan is blessed with solar potential of more than 5-6 kWH/m^2/day of irradiation in many areas. The potential is feasible for both Solar PV and Solar Thermal application. The area with highest solar potential is the province of Balochistan followed by Eastern Sindh and Southern Punjab promising technical and financially viable solar energy projects.
Biomass: Bagasse, rice husk, straw, dung, municipal solid waste, etc.	Pakistan's agricultural and livestock sector produces large amounts of biomass in the form of crop residues and animal waste, such as bagasse, rice husk, and dung, much of which is currently collected and used outside the commercial economy as unprocessed fuel for cooking and household heating. In addition, municipal solid waste produced by a large urban population is presently openly dumped, which could instead be disposed of in proper landfills or incinerated to produce useable methane gas or electricity. This sector has estimated potential of generating 4,000 MW of power.
Geothermal	There are several sites identified in different parts of the country having exploitable geothermal potential. Sites with different ranges of temperature and the pressure underneath the earth surface. The geothermal heat available at these sites can be used for power generation as well as internal heating/cooling purposes. However, exact potential for geothermal heat and power is still to be exploited. This sector has estimated potential of generating 2,000 MW of power.
Ocean	Pakistan is blessed with 1,046 km long coastal belt. There are several sites within this belt which can be exploited for power generation. However, exact potential of generating power from ocean is still to be exploited.
Biofuels	Pakistan being the agricultural country is having huge prospects for energy plantation. Around 34 million hectares of marginal land is available in different parts of the country that is best suited for this purpose. This has estimated potential to produce 50 million tones of bio-fuels per annum.

[1] PPIB
[2] USAID-NREL-AEDB-PMD study conducted in 2006

3.3 Policy Goals

Continuing with the policy goals and strategy outlined in the 2006 Policy, the ARE Policy 2011 endeavors to achieve the following:

- To achieve sustained and systematic deployment and growth of ARETs through effective federal and provincial coordination so as to achieve the target as envisaged in the ARE Policy 2011 and ensure universal access of ARETs across the country;
- To provide additional power supplies to help meet increasing national demand;
- Introduce and maintain investor-friendly benefits and incentives to encourage private sector participation and investment in ARE projects with a view, among others, to lower ARE costs and prices through competition in an increasingly deregulated power sector;
- Devise measures to support private sector in mobilizing financing and enabling public sector investment in the promotion and development of ARE projects;
- Encourage employment of ARET in off-grid and general households by displacing their dependence upon conventional sources with ARE sources;
- Optimize impact of ARE deployment in underdeveloped areas by integrating ARET based energy solutions and its productive use for income generating activities so as to alleviate poverty and improve livelihood by involving local communities; with special attention to diverse energy needs of men and women;
- Assist in the institutional, technical and operational capacity building of all parties involved in the ARE sector, including development of prototype contractual framework and business models, which may also be used by the Provinces/ AJK/ GB in the development of their respective ARE programs;
- Facilitate in the establishment of domestic ARET manufacturing basis in the country, among others, to lower costs, improve service, create employment and enhance local technical skills without in any way impeding or discouraging foreign investment or collaboration;
- Harmonize efforts of the various GOP and Provincial/ AJK/ GB governmental bodies engaged in ARE and coordinate their efforts in achieving the declared policy objectives.

3.4 Targets

Targets covered under the ARE Policy 2011 are those put forth in official development frameworks and policies and will be amended from time-to-time. Presently, the GOP has set the following targets for the ARE sector:

- At least 5% of total commercial energy supplies through alternative and renewable energy by 2030.

3.5 Investment Structures and Options

GOP encourages all commercially viable investment options for purposes of development of the ARE sector in Pakistan, and these projects will be entitled to all existing benefits and incentives available to conventional (hydel or thermal) projects in addition to the specific ARE sector incentives granted under the ARE Policy 2011. To this end, GOP is committed to promoting projects in any modalities, including purely in the Private Sector or the Public Sector or Public Private Partnerships.

3.6 Financing ARE

The GOP recognizes that access to financing is a critical issue for many ARE projects, particularly small and medium scale ARE projects. GOP will facilitate access to all available conventional financial and investment instruments, or as announced from time to time.

3.7 Carbon Credits

The CDM under the Kyoto Protocol extends to Pakistan being its signatory. GOP encourages the ARE project developers to apply for procuring carbon credits through CDM and mandates AEDB to facilitate, coordinate and assist the ARE project developers and the DNA in reconciling the most effective approach in procuring carbon credits. AEDB will also facilitate the ARE project developers in trading the carbon credits in international carbon market. The revenues generated through the sale of carbon credits will be exempted from income tax or duty.

The sale, management and distribution of carbon credits and the revenues actualized therein as a result of an ARE project will be done under a carbon crediting mechanism that AEDB will formulate within six (6) months of announcement of the ARE Policy 2011.

The AEDB will assist in the development of local CDM capacities as well as to carry out CDM promotion and awareness in ARE sector. In this regard, updated Grid Emission Baseline of Pakistan will be developed and made public within six months of the issuance of this Policy. In addition to the CDM, project developers may also consider VERs in the international voluntary markets.

Considering that efforts are on way to put in place new international climate treaties, GOP is committed to revising incentives for procuring benefits consistent therewith. AEDB is empowered to effect requisite facilitation in the event of any new international regime or protocol applicable to Pakistan.

3.8 Collection of Resource Data

The collection and dissemination of ARE project related data is important for the sustained development of the ARE sector. GOP, therefore, has resolved to empower AEDB to collect primary and secondary ARE data and assemble it into a usable form and

to make it readily accessible by potential investors and others interested in the ARE sector.

The AEDB will establish a central depository unit of ARE data collected through primary and secondary sources from time to time. Such data will be provided to interested parties upon attractive terms.

CHAPTER IV INCENTIVES AND PROCEDURES FOR GRID CONNECTED ARE PROJECTS

4.1 General Incentives

All qualifying ARE based power generation projects shall be eligible to avail benefits available to conventional power generation projects, in addition to those specifically outlined in this ARE 2011 Policy.

4.1.1 Guaranteed Market: Mandatory Purchase of Electricity

It shall be mandatory for NTDC/ CPPA/ DISCOs to buy all the electricity offered to them by ARE projects established pursuant to the ARE Policy 2011 at rates determined by NEPRA.

4.1.2 Grid Connection, Off-take Voltage and Interface

Electricity shall be purchased from ARE power projects at 220 kV at the outgoing bus bar of the power station of the project company if the power station is located within 70 km of an existing 220 kV transmission line, or at 132 kV if it is within 50 km of an existing 132 kV transmission line, or at 11 kV if it is within 5 km of an existing 11 kV distribution feeder, or at 400 V if it is within 1 km of a 400 V distribution feeder. The minimum average power to be supplied in each case would be 1,250 kW/km, 250 kW/km, 100 kW/km, and 20 kW/km, respectively. ARE-IPPs may also undertake to lay a new transmission line for connection with the main grid. The power purchase tariff determination will be adjusted accordingly for each of these options. The construction of transmission lines for evacuation of power from ARE IPPs set up for connection to the utility grid should be the responsibility of the power purchaser, unless the ARE-IPP, of its own choice, undertakes to install such infrastructure on a mutually agreed upon transmission charge with the power purchaser.

The net energy available for sale shall be determined after taking into account electrical efficiency, auxiliary loads, transformation efficiency, plant availability and other similar considerations, including for anticipated maintenance and outages. However, once EPAs are entered into, technical parameters shall not be varied except with the consent of the power purchaser.

4.2 Specific Incentives for ARE IPPs

Specific incentives are provided under this Policy to ARE IPPs selling all generated electricity (minus auxiliary consumption) to the grid.

4.2.1 Simplified Generation Licensing Procedure

ARE-IPPs up to 5 MW will enjoy simplified methodology and procedures for grant of generation licence by NEPRA. NEPRA will also facilitate by providing for a generic template license and a concessional fee structure for such initiatives.

4.2.2 Land and Site Access

GOP in coordination with relevant provincial/ AJK/ GB agencies will facilitate investors in the acquisition of appropriate land and rights of way ("**ROW**"). However, the primary responsibility as well as the cost of acquisition will be on account of the project company.

4.2.3 Wind and Hydrological Risks

The variability risk of all ARE resources including wind and hydrological risks shall be borne by the ARE-IPPs. No related risk cover will be considered in the tariff determination, as well.

4.2.4 Security Package

NTDC/ CPPA acting for the power purchaser shall enter into a specific Energy Purchase Agreement (**EPA**) with the ARE-IPP based on the standard model developed by the AEDB consistent with this Policy. The GOP shall also enter into an Implementation Agreement (**IA**), which will guarantee the payment obligation of the public sector power purchaser on account of power sales extending over the term of the EPA. The EPA will be based on the purchase of all power generated and delivered at a per-kWh rate, that is, there will be no capacity charge, capacity testing, risk, and penalty conditions implied. GOP through the AEDB shall also facilitate the acquisition of carbon credits as provided in this ARE 2011 Policy. The Security Package shall include the Site Sub-lease Deed in respect of projects who have been / would be allocated land by AEDB, and where required, a Water Use Licence Agreement ("**WUL**").

4.3 Tariffs

ARE-IPPs may avail either of these two categories of tariff to be determined by NEPRA in accordance with the NEPRA Act and the rules and regulations framed thereunder: (a) determined tariff; (b) tariff through competitive bidding, which will be subject to NEPRA approval. The tariff shall be determined on the basis of Energy Purchase Price (EPP) in Rs/kWh. However, NEPRA may consider two parts tariff [i.e. (1) Energy Purchase Price (EPP) (2) Capacity Purchase Price (CPP)] where applicable and other market best practices to adapt to the financing requirements for ARE projects.

In addition, ARE-IPPs could also benefit from feed-in tariffs to be determined by NEPRA, periodically for appropriate ARE sources, however, feed-in tariffs once announced shall be to the exclusion of the avenue of the determined tariff.

The benchmark currency rate used as a reference will be the interbank rate for US Dollars (US$) prevailing 30 days prior to the date the tariffs are determined by NEPRA. For unsolicited proposals or feed-in tariff regime, it will be the interbank lending rate as on the date of signing of the Engineering- Procurement-Construction (EPC) contract by the ARE IPP.

Indexation of various components of tariff and adjustment for foreign exchange rates ('true up') will be automatic, based on predetermined formulae and reference parameters.

ARE IPPs will not have to approach NEPRA frequently for tariff indexation; only yearly submissions may be required.

4.3.1 Rate of Return

GOP recognizes the economic, social and environmental benefits of ARE. In order to encourage sustained investment in the sector, it has been resolved that ARE projects be awarded rate of return in excess of that available to conventional power producers during the lifetime of the ARE project. Accordingly, this shall be ensured that the ARE projects shall be given preferential rate of return while calculating the tariff.

4.3.2 Premium on ARE Projects

GOP in its resolve to ensure fast growth of ARE projects will provide additional benefit of a premium to the tariff, for projects that are able to achieve financial close earlier than scheduled. AEDB has been mandated to coordinate and consult with NEPRA to develop the parameters, methodology, quotas and procedures for availing such premium, and is expected to notify the same within six (6) months from the coming in to force of the ARE 2011 Policy.

4.3.3 Feed in Tariffs

GOP recognizes that Feed-in Tariff has been globally tested tool to attract prompt investment in ARE sector. Feed in tariffs are therefore to be announced by NEPRA in respect of various ARE sources at such levels as deemed appropriate and duly supported by relevant NEPRA rules on the subject.

4.4 Specific Incentives for ARE DGs

4.4.1 Wheeling

For direct sales, where ARE DGs require to use national / regional transmission and/or distribution grid network to transport power from their project site to the point of interconnection of the power purchaser; such transmission and inter-connection services shall be acquired upon payment of corresponding transmission and inter-connection charges 'wheeling charges' as determined by NEPRA for the respective utility. This wheeling charge will reflect the cost of providing and maintaining the transmission interconnection, including the energy losses suffered *en route*, calculated on a utility-wide basis by NEPRA. For the purposes of connection, distribution codes and connection codes approved by NEPRA shall be referred.

4.4.2 Grid Spill Over

ARE DGs can enter into bilateral contract with the respective utility for sale of power in excess of their usage to the grid at rates determined by NEPRA.

4.4.3 Buy Back Mechanisms

GOP, visualizing the ARE resource potential in Pakistan believes that a significant potential in ARE can be employed through sale of part or all electricity to DISCOs produced by ARE DGs. NEPRA shall formulate clear and specific regulations for regulating sale/purchase of ARE between ARE DGs and the Utilities providing *inter* –

alia tariff and corresponding technical parameters for notification under the NEPRA Act. The following buy back mechanisms are envisaged under the ARE Policy 2011.

4.4.3.1 Net-Metering

A consumer based ARE DG up to 1 MW has an option to sell full or part of generated electricity to the grid, which is netted against the energy delivered by the grid. Under this mechanism utility consumers are encouraged to generate their own electricity from ARE resources. Under this arrangement the tariff charged would be the applicable retail tariff to the premise (e.g., industrial, commercial, or residential rates).

4.4.3.2 Banking

Energy generated by ARE DGs can be stored into the grid which is to be supplied back by the utility on demand. This mechanism is expected to support displacement of conventional power usage at small scale along with promotion of small scale ARE applications.

4.5 PROCEDURES FOR ARE-IPPs

The procedure that ARE-IPPs has to follow for executing their projects is described under following headings:-

4.5.1 Categories of Proposals

AEDB welcomes and shall process proposals for ARE-IPPs in coordination with relevant provincial/ AJK/ GB agencies on a solicited as well as unsolicited basis. In the case of unsolicited proposals, LOI shall be issued to enable the sponsors to carry out a feasibility study, obtain tariff and generation licence from NEPRA. Thereafter, the LOS shall be issued to assist the sponsors in achieving financial close for the project. In the case of solicited proposals, bids shall be invited by the AEDB inviting participation in a competitive bidding process. After evaluation of bids, the LOS shall be issued to the successful bidder to facilitate the project's financial close. The procedure is structured in line with NEPRA's powers and functions. The tariff arrived at after competitive bidding will be final and will not be re-opened by NEPRA.

4.5.2 Procedure for Unsolicited Proposals

Potential sponsors of ARE projects to be connected to the national or a utility's grid at a location of their choice ("**raw site**") may submit proposals consistent with the terms of ARE Policy 2011 to AEDB. The process flow is given in **Exhibit 4** below and is further explained in subsequent paragraphs.

Exhibit 4: Schedule for Unsolicited Grid-Connected ARE-IPPs

	Activity	Indicative Process time
1	Submission of proposal on raw site by sponsors	

2	Review of proposal and intimation of qualification of sponsors by AEDB (where required after consultation with relevant Provincial/ AJK/ GB agency)	Within 30 days from date of receipt of complete proposal
3	Posting of bank guarantee by sponsors	Within 15 days from intimation of approval of proposal
4	Issuance of LOI for an initial period of 24 months	Within 7 days of receipt of acceptable bank guarantee
5	Completion of Feasibility Study	Within the time specified in LOI (Maximum of 18 Months)
6	Procurement of Generation License	Any time within the validity period of LOI
7	Procurement of tariff from NEPRA	Any time within the validity period of LOI. NEPRA is required to announce its determination within 90 days of submission of petition by the project sponsor, In case if Feed-in tariff is announced, NEPRA will notify the tariff within fifteen (15) days submission of application by ARE-IPP.
8	Submission of Performance Guarantee by Sponsors	Within 15 days of grant of tariff by NEPRA
9	Issuance of LOS by AEDB for a period of 18 months	Within 7 days of receipt of acceptable Performance Guarantee
10	Execution of Security Package	Any time during validity of LOS
11	Financial Close	Within the time allowed in the LOS
12	Achieve Construction Start	Within the time allowed in the LOS/Security Package
13	Commissioning of Project	Within the time allowed in the LOS/Security Package

4.5.2.1 Submission of Unsolicited Proposals

Any sponsor wishing to undertake a project at a raw site would be required to submit a preliminary proposal to AEDB, which must be in compliance with applicable policy guidelines and include, at a minimum, the following:

i. Statement of qualification of project sponsors, listing relevant corporate experience, personnel, and financial capacity

ii. Project name and ARET classification (i.e., wind, solar, small hydro, etc.)
iii. Project location in compliance with grid compatibility criteria under section 3.1.2 of this Policy
iv. Proposed net installed capacity (MW)
v. Basic outline of plant and structures
vi. Summary implementation plan, milestones for project preparation, implementation and completion
vii. Any other information or data deemed relevant by the sponsors for consideration of the AEDB.

4.5.2.2 Evaluation of Unsolicited Proposals

Proposals for unsolicited projects on raw sites will be examined by a Project Committee appointed by the AEDB in the first instance, and if found appropriately qualified, AEDB in consultation with the provincial/ AJK/ GB agencies concerned, process the case for issuance of LOI.

4.5.2.3 Issuance of LOI; Extension

LOIs for raw sites shall include relevant project details and milestones and lay down the mechanism or procedure for monitoring progress by AEDB. AEDB shall specify initial validity period of the LOI depending upon the size, schedule and other relevant considerations regarding the project, however, initial validity period of the LOI shall not exceed 24 months from its effective date. AEDB shall issue LOI against a bank guarantee in favour of AEDB and in the amount specified in Section 4.7.1. The said bank guarantee shall be issued by an 'A' rated scheduled bank in Pakistan and shall be valid for a period not less than six (6) months in excess of the initial validity period of the LOI.

AEDB may allow one-time extension in the validity period of the LOI on a case-by-case basis, but such extension shall not be for a period more than 06 months from the scheduled date of its initial expiry. Such extension shall be subject to and become effective upon the sponsors submitting another bank guarantee valued at twice the original amount (i.e., USD 1,000 MW), which shall be valid for a period six(6) months in excess of the extended validity period of the LOI. The earlier bank guarantee shall be returned to the sponsors upon submission of the subsequent bank guarantee of the abovementioned enhanced value.

In during the currency of the LOI, a project sponsor wishes to withdraw from the project, the extent to which the Bank Guarantee amount shall be encashed will be in proportion to the time elapsed such the issuance of the LOI with respect to the total period of the LOI. However, in the event, the project sponsor opts to withdraw from the project due to non-acceptance of tariff as determined by NEPRA, the Bank Guarantee shall be returned by AEDB.

4.5.2.4 Feasibility Study

The sponsors shall enjoy exclusive rights to carry out a feasibility study at a given raw site within the specified period.

The feasibility study will be reviewed by a 'Panel of Experts' ("**POE**") appointed by AEDB. If at any time during the feasibility study period, the POE determines that the sponsors have failed to adhere to relevant milestones or rectify such deviation, or are not diligent, the AEDB may serve a notice to the LOI holder to rectify the situation within the period recommended by the POE, failing which the LOI shall be deemed terminated and AEDB shall be deemed authorized to encash the Bank Guarantee. In such a case, the sponsors will have no claim for compensation against AEDB or any of the federal/ provincial/ AJK/ GB agency concerned.

Feasibility studies undertaken by the public sector and donor agencies will be made available to all interested private entrepreneurs by the AEDB upon payment of nominal administrative fee or a service charge to be prescribed by the AEDB. The full cost of the feasibility study (up to a reasonable ceiling and as reflected on the books of the concerned agency as being the actual cost of the feasibility study), shall be indicated in the LOI and shall be charged to the project developer at the time of issuance of the LOS, and shall be reimbursed to the agency which originally conducted the study, except in the case where such study was conducted under grant financing (e.g., donor funding, etc.). Wherever the GOP or a provincial government/ AJK/ GB agency has obtained such a feasibility prepared by the public or private sector, preference would be given to the award of these projects through international competitive bidding ("**ICB**"). For studies furnished to the private sector by the AEDB or any public sector organization, investors shall be responsible for verifying any or all aspects of the relevant feasibility study, and would be encouraged to carry out additional or alternative project appraisal of the site on their own. In case the feasibility has been completed by the public sector or private sponsor but the unsolicited proposal does not materialize for any reason whatsoever, and the AEDB wishes to invite bids using the same feasibility study, then the cost of feasibility study (up to a reasonable ceiling and as per proper audit) will be recovered from the successful subsequent bidder, if any, and be reimbursed to the public sector entity or sponsor who originally paid for, or conducted, the study.

4.5.2.5 Determination of Tariff

Upon completion, the feasibility study will be reviewed by the POE, and if approved, the project sponsors will be expected to apply to NEPRA for obtaining generation license and determination of tariff within a period not exceeding 02 calendar months from the date of approval of feasibility study by AEDB. In case if NEPRA has notified the feed-in tariff, the tariff process would likely be significantly shorter. Refer to tariff annex here

4.5.2.6 Letter of Support; Performance Guarantee

Subsequent to the determination of tariff by NEPRA and acceptance by the project sponsor, it shall be required to post a performance guarantee in favour of AEDB and in the amount specified in Section 4.7.1, which shall be valid, initially, for a period of 6 months in excess of validity of the period of the LOS. Upon submission of the said performance guarantee, the LOS shall be issued to enable the project to achieve financial close and the original bank guarantee furnished at the time of issuance of LOI shall be released. The LOS shall exclusively govern the project and supersede all previously

issued letters and instruments until the project achieves the financial closure.

4.5.3 Procedure for Solicited Proposals

4.5.3.1 Process Flow

Proposals for projects at pre-selected sites may be solicited by AEDB through public advertisement. These may include sites/projects for which feasibility studies have already been completed in the public sector, as well as 'raw sites' not yet fully investigated. Such projects will be processed according to the steps and schedule given in **Exhibit 5**.

Exhibit 5: Schedule for Solicited Grid-Connected ARE-IPPs

	Activity	Indicative Process time
1	Identification of specific projects by AEDB and invitation of Expression of Interest	
2	Registration and collection of documents from AEDB	Within 30 days of invitation
3	Evaluation of prequalification documents and notification of pre-qualified bidders by AEDB	Within 30 days from last date of registration
4	Requests for proposal (RFPs) from pre-qualified bidder(s) and collection of bidding documents	Within 30 days from date of intimation of successful bidder(s)
5	Submission of bids to AEDB together with bid bond and evaluation fee	Within 90 days of date of issuance of RFP
6	Evaluation of bids by AEDB, including preliminary tariff determination and notification of successful bidder	Within 30 days of acceptance of bid
7	Submission of Performance Guarantee by successful bidder	Within 15 days of notification of successful bid
8	Procurement of Generation License from NEPRA	Within 30 days of acceptance of performance guarantee by AEDB
9	Issuance of LOS by AEDB	Within 7 days of receipt of generation license
10	Execution of Security Package	Any time during validity of LOS
11	Commissioning of Project	Within the time allowed under the LOS/Security Package

4.5.3.2 Raw Sites

For raw sites, AEDB shall invite an Expression of Interest ("**EOI**") and make available to

the investors the relevant ARET, location, and other preliminary information. Successful bidder shall be awarded the LOI for the project. The rest of the process for proposal submission and evaluation shall be identical to that described for unsolicited proposals (see previous section).

4.5.3.3 Other Sites

For sites in respect of which feasibility studies may have been completed prior to bid solicitation, specific tender documents will be prepared and bids will be invited for the sale price of electricity (against NEPRA's indicative tariff or Feed-in tariff if announced as a benchmark, using the same parametric formulation to allow for a standardized comparison basis). The successful bidder shall be awarded the LOS to help achieve financial close. The schedule of activities leading to issuance of LOS will be as give in **Exhibit 5**. AEDB may, however, where deemed appropriate for sake of efficiency seek proposals through advertisement in two envelopes; one containing the technical bid and the other financial bid. The said financial bids shall be opened for bidders whose technical bids are qualified.

4.5.3.4 Request for Proposal (RFP)

The RFP for solicited projects will contain all project specifications, components, and requisite details necessary for the preparation of a proper technical and financial bid. The documents will also explain the evaluation criteria to be employed in scoring the bids. If necessary, AEDB may hold a pre-bid conference to facilitate exchange of information with qualified sponsors, giving equal and adequate opportunity to all prospective bidders to seek clarification on project requirements.

4.5.3.5 Bid Bond, Letter of Support and Performance Guarantee

A bid bond based on the project's installed generation capacity shall be required from each bidder at the time of submission of bids. After selection of the successful bidder, the bid bonds of all bidders other than the sponsors of the successful bid shall be returned, and the successful bidder will be required to post a performance guarantee based on project capacity in favour of the AEDB for issuance of the LOS, and which shall be valid, initially, for a period of 06 months in excess of validity of the LOS. After submission of the performance guarantee by the successful bidder, the bid bond shall be returned and the LOS issued to enable the project to achieve financial close. The LOS shall exclusively govern the project and supersede all previously issued letters and instruments until the project achieves the financial closure.

The said performance guarantee will secure the successful bidder's obligations to execute the security package and other relevant agreements and achieve financial close within the specified time period. In addition, the sponsor may also be required to reimburse the cost of feasibility study utilized (if so indicated in the bidding documents). The said performance guarantee shall be in the form of an irrevocable, direct-pay letter of credit, issued by a scheduled local or foreign bank acceptable to, and in favour of, the AEDB. If the performance guarantee is not furnished within the specified period, the LOS shall lapse automatically, and neither the sponsor nor the project company shall have any claim

for compensation or damages against each other or any agency of the federal, provincial/AJK/GB government or any of their respective departments or organizations.

4.6 Other Significant Conditions

4.6.1 Legal Structure and License Requirement

For supply of power to the national grid, ARE-IPPs will be required to form a company under the Companies Ordinance, 1984, having the sole object of power generation and obtain a generation license from NEPRA. However, ARE DGs shall not be required to register as a company under the Companies Ordinance, 1984. ARE DGs can install plants for their dedicated use without getting a license from NEPRA. Such ARE DGs can also avail accelerated depreciation on their plants and equipment.

4.6.2 Capitalization and Lock-in Period

The "main sponsor" must hold issued and paid up shares in the project company of not less that 20% of the authorized capital at the time of grant of LOS, subject to the aforesaid minimum paid up capital. The "main sponsors" and the "initial shareholders", together must hold a minimum of 51% equity in the project company up to the commercial operations date.

4.6.3 Security Package

The security package for grid-connected ARE-IPPs will comprise of Implementation Agreement (IA), Energy Purchase Agreement (EPA), and Water Use License Agreement (WUL), and any other agreement as applicable.

4.6.4 Type of Contracts

EPA with ARE-IPPs for sale of all power to the grid system may be implemented through contracts forming a part of the security package having a validity period of not less than 20 years.

For the other type of projects, no such contracts shall be required. Instead, for projects availing buy back mechanisms, separate contractual arrangements will be required between the parties dealing with matters such as metering, maintenance of interconnection, system protection, and billing of net sales and purchase, wheeling, and banking charges/tariffs, etc. to be notified by NEPRA.

4.7 Fees and Charges

4.7.1 Fee Structure for Grid connected ARE-IPPs

The following fees and charges are payable to AEDB by the sponsors of grid-connected ARE Projects. All fees are subject to revision by the AEDB from time to time, and these are in addition to any other fees and charges payable for development of the project by the sponsors/project sponsors to other federal, provincial/ AJK/ GB agencies.

Exhibit 6: Fee & Financial Charges for Grid-Connected ARE-IPPs

1	**Registration** - with AEDB	100	Payable at Registration. The

			AEDB. will provide an information package upon registration
2	**Pre-qualification** - Purchase of Prequalification Documents	1000	Payable at purchasing Prequalification Documents. AEDB will provide detailed Prequalification Document
3	**Bidding** - Purchase of RFP	2,000	Payable at issuance of RFP. The RFP by pre-qualified bidders shall also include the feasibility study, where relevant, and standard, IA, EPA, etc., as applicable
4	**Evaluation** - Project facilitation and evaluation expenses for projects: ≤ 5 MW > 5 MW but ≤ 20 MW > 20 MW but ≤ 50 MW > 50 MW but ≤ 100 MW > 100 MW an above	 2,000 10,000 20,000 30,000 50,000	ARE-IPP to pay upon acceptance of LOI proposal by AEDB
5	**Bank Guarantee** - For issuance of LOI by AEDB to Solicited Projects Unsolicited Projects	 1,000/MW name plate capacity or bid bond specified 1,000/MW name plate capacity	ARE-IPP to post the BG upon acceptance of LOI proposal by AEDB.
6	**Feasibility Study** - Reimbursement of public sector feasibility cost, if applicable Reimbursement of private sector feasibility cost, if applicable	As determined by AEDB As per cost ascertained by AEDB from relevant accounts	Payable prior to issuance of LOS, based on actual costs incurred, up to maximum ceiling
7	**Performance Guarantee** - for issuance of LOS by AEDB to solicited as well as unsolicited projects	5,000 per MW capacity	Payable upon approval of power purchase tariff by NEPRA
8	**Legal Fees** ≤ 5 MW > 5 MW but ≤ 20 MW > 20 MW but ≤ 50 MW	Subject to a cap of 10,000 25,000 60,000	The Slab Ceiling is a maximum cap. This is payable to AEDB at time of start of project documents negotiations

	> 50 MW but ≤ 100 MW	150,000	with stakeholders.
	> 100 MW and above	250,000	

Note: Upon financial close, the ARE-IPP will provide a letter of credit to the power purchaser as performance guarantee as specified in the EPA (US$ 3/kW per month), subsequent to which the original Performance Guarantee furnished at the time of issuance of the LOS shall be released.

CHAPTER V STANDALONE APPLICATIONS

5.1 Off-Grid Applications

GOP designates AEDB to assist all concerned authorities at the provinces, AJK and GB in the development and implementation of off-grid electrification of rural areas using ARETs. GOP is committed to continue schemed deregulation and simplification of off-grid power generation wholly for captive or dedicated use or for supply to local communities through small, isolated distribution lines and stand alone systems.

5.2 Energy Services

GOP is committed to utilizing ARE resources to match the diverse energy needs of the men and women both in urban and rural population at affordable costs; while retaining primary focus on energy conservation and income generation by providing sufficient access to modern energy services for different applications including but not limited to, lighting and computer facilities in academic buildings, water pumping for irrigation and drinking purpose, water heating, fruit drying, refrigeration, cottage industries, and local communication centers. To this end, the AEDB as the GOP designated entity shall take measures:

- To prepare in collaboration with the federal, provincial/ AJK/ GB agencies concerned an appropriate "Rural Energy Services Vision" Plan and a master plan for implementation on balanced geographical bases with, among others, a view to minimize total costs of supply, and develop adequate monitoring of the integration of ARE programs in the national grid extension programs.
- To encourage private sector, particularly small-medium scale enterprises, in the promotion of ARE systems for rural applications as part of an integrated national plan for off-grid technologies and models for service delivery, and the special incentives that may be given to ARE rural energy service delivery;
- To develop in collaboration with federal, provincial/ AJK/ GB and other stakeholders relevant technical standards, codes and guidelines and the development of effective legal and regulatory enabling framework;
- To initiate capacity building programs to aid in the implementation of ARE strategy and plan; and
- To deploy ARETs for conservation of conventional fuel and energy and to combat deforestation.

CHAPTER VI ALTERNATIVE FUELS

6.1 Objectives

GOP is determined to achieve greater energy security by creating an enabling environment for easing dependence on imported petroleum by encouraging and facilitating increasing reliance on Alternative fuels, which in turn will not only enhance environmental and social objectives but also result in tangible economic advantages. GOP has designated AEDB to play a vital role in integrating various initiatives within and outside the public sector with the strategic aim of realizing true potential of Alternative fuels.

6.2 Classification

This ARE 2011 Policy mainly focuses on Biogas, Biofuels (biodiesel and ethanol), Fuel from Waste (Refuse Derived Fuel, Processed Agricultural and Industrial Waste) and Hydrogen.

6.2.1 Bio-Diesel Programme

GOP announced its bio-diesel programme in 2008 whereunder targets have been fixed for selling bio-diesel blended diesel fuel in Pakistan. By 2015 at least five percent (5%) bio-diesel shall comprise the annual volume of diesel fuel (B5) and by 2025 at least ten percent (10%) bio-diesel shall comprise the annual volume of diesel fuel (B10), actually sold and distributed by each and every Oil Marketing Company (OMC) in conformity with the applicable fuel quality standards in Pakistan.

OGRA will announce the pricing mechanism for bio-diesel within six months of the announcement of ARE Policy 2011. The import of B100 is exempted from all taxes and duties. The GOP shall consider scaling up of further incentives for feedstock growers. The following incentives will be available:

- Mandatory purchase of B100 bio-diesel, as well as various blends, by Oil Marketing Companies from bio-diesel suppliers, such as refineries or importers;50% of the bio-diesel production shall be from indigenous resources by 2015;
- In case of shortages in local bio-diesel supply prior to 2015, OMCs, are permitted to import volumes equivalent to shortfall, subject to certification by AEDB;
- Ministry of Petroleum and Natural Resources shall notify standards for B-100, B5, B10 and other bio-diesel blends within three months of the announcement of this policy;
- A minimum of one percent (1%) bio-diesel by volume to be blended into all diesel fuel sold in Pakistan within one year of the announcement of this policy.

6.2.2 Ethanol

GOP has issued successive polices in May 2009 and October 2009 for introduction of Ethanol-10 (E-10) for vehicular usage and OGRA has been designated as the entity to determine ex-depot and retail price of E-10. All incentives available for bio-diesel will also be applicable to Ethanol in context of gasoline replacement.

6.2.3 Certification

All entities involved in growing, processing, importation, and/or sale of feed stocks and biofuels (B100 & E100) shall be certified by AEDB under appropriate certification regulations.

6.3 Hydrogen

Hydrogen has been identified as a proven alternative fuel internationally. GOP encourages utilization of Hydrogen as one of the important alternative fuel source with promising impact on the overall energy mix in the long run. AEDB is mandated to support pilot projects for Hydrogen production in collaboration with academia and public and private sector organizations.

6.4 Biogas

ARE Policy 2011 envisages to promote Biogas technology to meet the domestic and commercial energy needs through facilitation and support mechanism.

6.5 Environmental and Social Impacts

GOP appreciates the requisite attention to the environmental and potential social impacts of Alternative Fuels from procurement of raw material and production to refining and consumption. The Pakistan EPA shall develop emissions standards for Alternative Fuels based on their emissions profiles including, but not limited to, aldehydes or the use of methanol in biodiesel production and Environmental and Social Assessment Guidelines for biodiesel plantations. AEDB will work with MinFAL to develop guidelines for plantation in the area of marginal soil.

6.6 Awareness and Demonstration

Successful implementation of ARE Policy 2011 requires dissemination of accurate information about ARE, its benefits, its impact on poverty alleviation, women empowerment and contribution to overall energy requirements of the populace. AEDB will undertake mass awareness programmes for ARET applications. AEDB, in collaboration with relevant institutions, academia and research institutions, will continue to engage in R&D for establishing ARE technology base and requisite training of technical manpower for ARE sector in Pakistan. Incentives, both fiscal and financial extended for ARE projects in Pakistan, shall also be available for setting up of manufacturing base for ARE plants and accessories.

6.7 Special Promotional Projects

Development of commercial scale ARE projects is envisaged under the AEDB Act, additionally, it shall encourage adoption of ARE applications like solar water heaters, solar cookers and other technologies utilizing ARE sources.
The collection of data/information relating to contribution of ARE resources to the overall energy mix has an instrumental role in the development of ARE in Pakistan. AEDB will ensure acquisition of all relevant data pertaining to different aspects of ARE usage and penetration in Pakistan such that future policy decisions are founded on sound analytical statistics of ARE.

GOP is conscious of the phenomenal role of women in promoting ARE. AEDB is mandated to attend to their peculiar energy needs while executing ARE promotional projects.

CHAPTER VII SUMMARY OF INCENTIVES

7.1 Incentives

GOP has resolved to extend all existing benefits under ARE Policy 2006 to ARE Policy 2011. A complete list of these incentives is given below:

7.2 Incentives for ARE-IPPs, ARE-DGs & AFPs

7.2.1 Fiscal Incentives

- No customs duty or sale tax for plant, machinery, equipment and spares (including construction machinery, equipment, and specialized vehicles imported on temporary basis) meant for the initial installation or for balancing, modernization, maintenance, replacement, or expansion after commissioning of ARE projects subject to fulfillment of conditions under the relevant SROs. All imported plant, machinery, equipment and specific items used in the production of Alternative Fuels shall also be exempted from Customs Duty and Sales Tax
- Parties may raise local and foreign finance in accordance with regulations applicable to industry in general. GoP approval may be required in accordance with such regulations.
- Non-Muslims and non-residents shall be exempted from payment of Zakat on dividends paid by the company.

7.2.2 Financial Incentives

- Non-residents allowed purchase of securities issued by Pakistani companies without State Bank of Pakistan's permission, subject to prescribed rules and regulations.

7.2.3 Risk Cover

GOP has developed a security package consistent with international best practices which offers protection against "political" risk in a manner consistent with GOP policies in other infrastructure and related projects;

7.3 Incentives Exclusive for ARE–IPPs,

7.3.1 Fiscal Incentives

- Exemption from income tax, including turnover rate tax and withholding tax on imports.

- Repatriation of equity along with dividends freely allowed, subject to rules and regulations prescribed by the State Bank of Pakistan.

7.3.2 Financial Incentives

- Permission for power generation companies to issue corporate registered bonds.
- Permission to issue shares at discounted prices to enable venture capitalists to be provided higher rates of return proportionate to the risk.
- Permission for foreign banks to underwrite the issue of shares and bonds by ARE-IPPs to the extent allowed under the laws of Pakistan.
- Independent rating agencies in Pakistan to facilitate informed decision-making by investors about the risk and profitability of project company's bonds/TFCs.

7.3.3 Risk Cover

Significant risks covered are:

- GOP guarantees payment obligations under the EPA in respect of projects to whom AEDB issues LOI and/or LOS;
- Safeguards in the event of privatization of any power purchaser or other constituent public sector entity;
- Protections against change in law, including tax and duty impositions;
- Foreign Exchange approvals and facilities commensurate with those in place for conventional power projects;
- Ensure convertibility of Pakistani Rupees into US Dollars at the prevailing exchange rate and the remittance of foreign exchange to cover necessary payments related to the project, including debt servicing, payment of dividends, and repatriation of equity.
- Indexation of tariff to cover exchange rate and inflation etc. consistent with that available to conventional power projects.

7.4 Incentives Exclusive for AFPs

7.4.1 Fiscal Incentives

- No petroleum levies and duties shall be imposed upon B100 bio-diesel blend.
- Biodiesel blend petroleum products (e.g., B5, B10) and Ethanol blend petroleum products (e.g., E5, E10) shall not be liable for petroleum duties or levies on the non-petroleum portion (by volume) of their constituents.
- The import of B100 shall be exempted from Customs Duty, Income Tax and Sales Tax.
- Exemption from income tax, including turnover rate tax and withholding tax on imports.
- Parties may raise local and foreign finance in accordance with regulations applicable to industry in general. GoP approval may be required in accordance with such regulations.

7.4.2 Financial Incentives

- Permission to issue corporate registered bonds.
- Permission to issue shares at discounted prices to enable venture capitalists to be provided higher rates of return proportionate to the risk.
- Permission for foreign banks to underwrite the issue of shares and bonds by AFPs to the extent allowed under the laws of Pakistan.
- Independent rating agencies in Pakistan to facilitate informed decision-making by investors about the risk and profitability of project company's bonds/TFCs.

7.4.3 Risk Cover

Significant risks covered are:

- GOP guarantees purchase of various blends of bio-diesel and ethanol by Oil Marketing Companies
- GOP encourages growing feedstock for bio-fuels in marginal lands
- Safeguards in the event of any statutory change in public sector;
- Protection against "political" risk in a manner consistent with GOP policies in other infrastructure and related projects;
- Protections against change in law, including tax and duty impositions;