Comparative Study of Renewable Energy Policies of Pakistan with World

By
MUHAMMAD JUNAID ALAM
Reg# 00000277911
Session 2018-20

Supervision by
Dr. MUHAMMAD HASSAN

A Thesis Submitted to U.S.-Pakistan Center for Advanced Studies in Energy partial fulfillment of the requirements for the degree of

MASTER of SCIENCE in
ENERGY SYSTEM ENGINEERING

U.S. – Pakistan Center for Advance Studies in Energy (USPCAS-E)
National University of Sciences and Technology (NUST)
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THESIS ACCEPTANCE CERTIFICATE

Certified that final copy of MS/MPhil thesis written by Mr. MUHAMMAD JUNAID ALAM, (Registration No. 00000277911), of U.S.-Pakistan Center for Advance Studies in Energy (School/College/Institute) has been vetted by undersigned, found complete in all respects as per NUST Statues/Regulations, is within the similarity indices limit and is accepted as partial fulfillment for the award of MS/MPhil degree. It is further certified that necessary amendments as pointed out by GEC members of the scholar have also been incorporated in the said thesis.

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DEDICATION

This thesis is wholeheartedly dedicated to Almighty Allah, thank you for the guidance, strength, power of mind, protection and skills and for giving me a healthy life and my beloved parents, who have been my source of inspiration and gave us strength when I thought of giving up, who continually provide their moral, spiritual, emotional, and financial support. Secondly, I dedicate this work to my faculty supervisor Dr. Muhammad Hassan and my GEC members who helped me in thick and thin situation and shared their words of advice and encouragement to finish this thesis.

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ABSTRACT

This thesis discusses the comparison of public policy measures on renewable energy (RE) in electricity generation in Pakistan with the world. Using a combination of new data sets and longitudinal research designs, this investigates the impact of different policies and their steps in a sample of both developed and underdeveloped countries to propose an effective policy combination that can overcome market failures for clean energy. The results require special technology policies that consider real market conditions and technological maturity. To improve institutional investment conditions, the proposed policy instruments include economic and fiscal incentives such as feed in tariffs (FIT), especially for less mature technology. In addition, market-based instruments such as greenhouse gas (GHG) trading systems for mature technology must be included. Also includes SWOT analysis to reconsider different aspects to identify and compare Pakistan's internal strengths and weaknesses, as well as its external opportunities and threats regarding the implemented policies and their impact, also includes PESTEL analysis or PESTLE analysis (formerly known as PEST analysis) as a framework or tool used to analyze and monitor the macro-environmental factors that may have a profound impact on Pakistan's renewable energy policies performance both technologically and in implementation, along with some supply and demand mathematical model relationship between the quantity of a commodity that Pakistan's renewable energy producers wish to sell at various prices and the quantity that consumers wish to buy. It is the main model of price determination used to elaborate future demand in economic theory with curves to compare Pakistan with several countries. These policy steps directly affect the structure of risk and return on Renewable Energy projects. Complementing this with regulatory measures such as codes and standards (e.g. AEDB and NEPRA) and long-term strategic planning can further strengthen the Renewable Energy investment context. Using all the sources the trial information obtained from the use of projects in the field can be put to rest by PCRET, and the AEDB can build the best foundation using this information as input. To deal with problems involving this country, this process is likely to make more available screening grounds. In addition, the Government can sincerely persuade donors and improve institutions to provide funding to banks so that IPPs can be successfully implemented.

Keywords:

Renewable Energy Policy, Comparative study, SWOT analysis, PESTEL analysis, Supply and Demand comparative analysis, Multi criteria decision analysis.

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LIST OF ABBREVIATIONS

EPA Environmental Protection Agency

HVAC Heating Ventilation and Air Conditioning

SPIC State Power Investment Corporation

MNRE Ministry of New and Renewable Labor

CSP Concentrated Solar Power

USRG US Renewable Group

NCPA Northern California Power Agency

FiT Feed-in-Tariff

NREL National Renewable Energy Laboratory

LoS Letter of Support

LoI Letter of Intent

REN21 Renewable Energy Policy Network for the 21st Century

DISCO Distribution Company

a Electricity Demand

b Consumption Factor

E Energy

P Price

c Electricity Supply

d Capacity Factor

P' Equilibrium Price

E' Equilibrium Energy

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CHAPTER 1

Introduction

There is no doubt that the world's energy demand has increased substantially recently by 1.3% and growth is expected to reach 61% between 2010 and 2040[1], [2]. In the meantime, the energy market is facing more challenges, such as limiting fossil fuel reserves, increasing population, lack of energy security, increasing economic, urbanization and scarcity of water, especially in desert and arid regions. Since its creation on Earth, energy has been a major requirement for mankind. The growing population and species of modernization have led to an increase in overall energy consumption requirements and per capita energy consumption, respectively

In order to address this future gap between energy supply and demand, as well as to consider the risks of global climate change due to greenhouse gas emissions and other pollutants from excessive fossil fuel combustion, much attention was focused on renewable energy sources and efficiency measures. That is why developing a renewable energy project is considered a huge opportunity not only from a strategic and financial perspective, but also through technical and environmental issues[2], [3].

On the other hand, governments play a major role in developing by establishing strategic plans and adopting adequate mechanisms. These policies can affect the prices of conventional and renewable electricity, not only through subsidy reforms and taxes, but also through dedicated funding, electricity generation and grid access laws[2], [3].

Modernization and per capita energy consumption have a stimulating effect on one another, namely the rise of one giving birth to another. The per capita consumption of some countries is shown in Table 1.1. According to which China is advancing India and Pakistan in per capita consumption [4]–[6].

Table 1.1 Per capita consumption of electricity

Country	**Total Consumption in Billion kWh**	**Per Capita Consumption in kWh**
China	5564	3995
Russia	909.60	6296
US	3902	11927
UK	309.20	4650
France	450.80	6730
Germany	536.50	6469
Pakistan	92.33	435
Turkey	231.10	2807
India	1137	841
Bangladesh	53.65	332

Individual land use indicates that more energy is used in each sphere of society. Per capita energy consumption is directly proportional to the country's economic growth. Countries such as China, France and the USA have the highest energy intake per capita, as a result these countries have rapid economic growth[6]–[8].

To enrich industrial progress, the most popular form of energy used these days is electricity. The modern power system is an interconnected network built by generating, transmitting, distributing and using energy. Power is usually generated in remote locations where the transmission network is stretched to transfer power to load centers. The available power is then distributed to consumers through a distribution network. Electricity is an important element of modern society. Therefore, it is necessary to highlight each generator. At the end of 2017, the global electricity capacity was 25721 TW h. The major contributors are 66.8% of coal and other resources include: 10.2% nuclear, 16.3% renewable energy and other renewables such as wind 4.4%, solar power 1.8%, biofuels 2.3% and other 0.5% [6]. As shown in Figure 1.1.

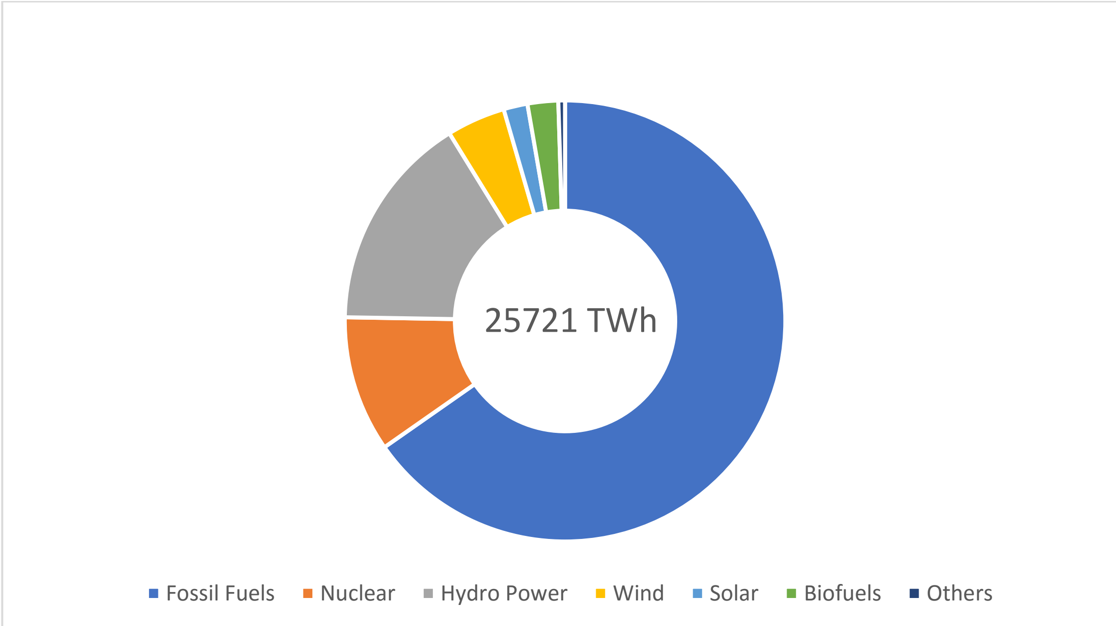

Figure 1.1 Share of Global energy Resources [6]

Existing fossil fuel resources are filling up fast which is causing a great deal of dependence on their economically viable prices. On the other hand, the use of saturated fossil fuels has a negative impact on the environment due to the emission of harmful gases such as CO2, SOx, and NOx commonly known as greenhouse gases [6], [9], [10]. China is the leading country in GHG with 10.29 billion tones and India is in third place with 2.24 Mt of CO2[6], [11]. The accumulation of these gases in the atmosphere has led to some serious environmental problems such as increasing levels of pollution and dramatic changes in the earth's climate. According to the US Environmental Protection Agency (EPA) total GHG emissions increased by 42 percent in the period 1990 to 2014 due to human activities [6], [12]. Coal generation of minerals is the largest contribution of GHG [6], [13]. To mitigate these adverse effects on the environment, the European Commission on Climate Action has set the goal of reducing GHG emissions by at least 20% less than in 1990 To address the economic and environmental issues associated with global oil saturation and achieve the goal of reducing GHG emissions, Renewable Energy Resources (RES) are the best solutions to meet the growing energy demand. RES, though producing green energy, has no problems. Large capital expenditures, mergers, difficulties in maintenance and problems in grid connection are major obstacles to the adoption of renewable energy Some developed countries incorporate renewable energy into their energy systems at high speeds but many countries continue to add large amounts of energy, resulting in less renewable energy. So, because of the barriers to the adoption of renewable energy, the world's energy sector still relies on fossil fuels.

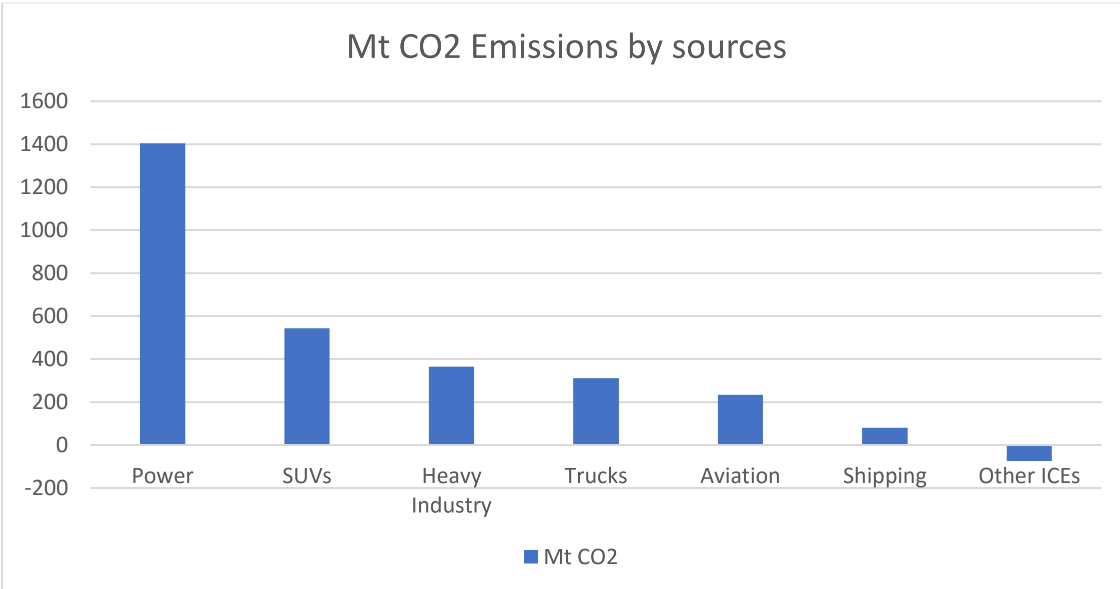

Figure 1.2 Change in global CO2 emissions by energy sector, 2010-2018 [16]

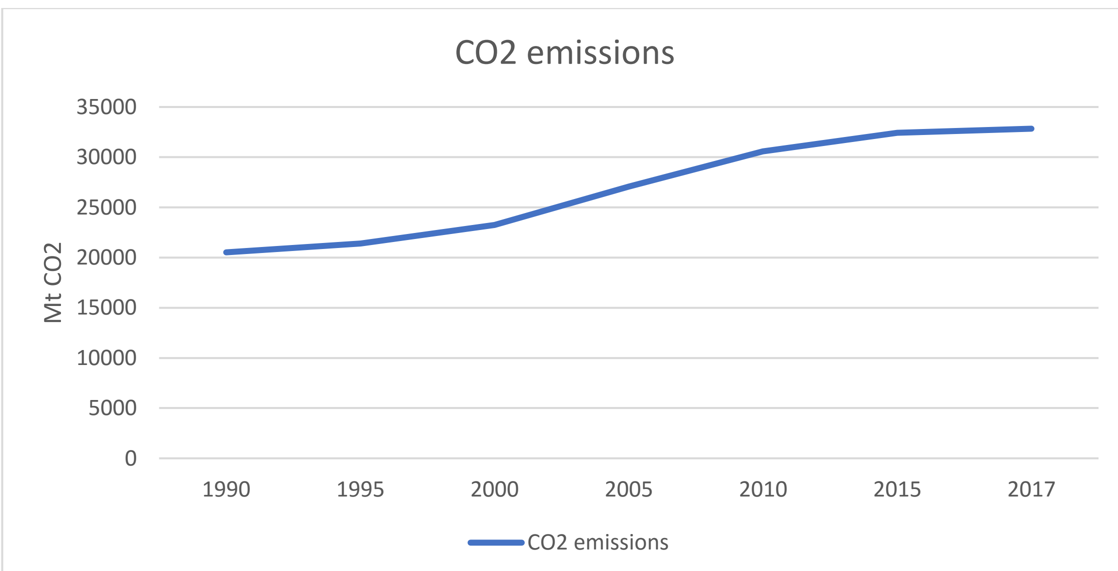

Figure 1.3 Total CO2 emissions, World 1990-2017 [17]

The effective, durable and healthy energy profile of a country determines how well it is prepared to fight for future energy needs [18]. Today the whole world is focused on achieving energy-based emissions that are the result of increased pollution as a result of the emission of carbon dioxide from thermal power plants [19]. It is believed that the cause of World War II will be a shortage of energy resources. Therefore, designing a framework for global energy policy is a major time requirement to bring about clean energy transformation[20]. The sources of energy are divided between

i. Renewable Energy Sources

ii. Non-renewable Energy Sources [20]

Renewable Energy Resources are clean, pollution-free and environmentally friendly. These include hydro energy, wind energy, sun energy, geothermal energy and tidal energy. Conventional energy sources have been used for energy production and consumption for the last three centuries. These are also called fossil fuels and include: coal, crude oil and natural gas[20].

Therefore, among the first steps to visualize the transition from conventional power systems to a diverse portfolio of power plants including RES using smart grid technology for more efficient systems, providing road maps including frameworks and regulatory strategies are key findings[2].

To do so, the strategy used to advice on the first steps towards a profitable RE regulatory framework is to begin a review of the success and failure of policy experience worldwide to promote renewable energy technology (RET), and to conclude the most effective steps and lessons learned.

1.1.Energy Problems

This century discusses the great power challenges throughout the world. Economic development and population growth expand labor demand. Safety, funding, and mitigation of climate change and social objectives. Poverty. Complicated and complicated problems. Finite fossil fuels, labor safety, increased pollution from the operation of the power of profit, and increased changes have increased the uncertainty and paradox that is beneficial in economic growth, power supply, and the surrounding natural environment. Release of fossil power, global warming, and transition from the safety of the natural environment, energy safety, and the discourse of power system interactions with the natural surroundings. The issue of climate change has supported the global community to build clean power for the development of trays, the safety of the natural environment and energy[25], [26]. As, the safety of labor is obtained by the provision of survivors through the efforts of a country to optimize the portfolio of labor resources and extract the resources of the desired stock to perpetuate economic development and welfare development. In addition, Goal 7 (Power that is able to provide and clean for all) and Goal 13 (immediate action to improve climate change) in Sustainable Development Goals also help countries to develop clean power[27]. In addition, insufficient resources, rising oil prices, rising energy demand, uncertain supplies, and economic growth have made the kingdom aware that fossil fuels cannot guarantee supplies and the sustainability of future survivors[28].

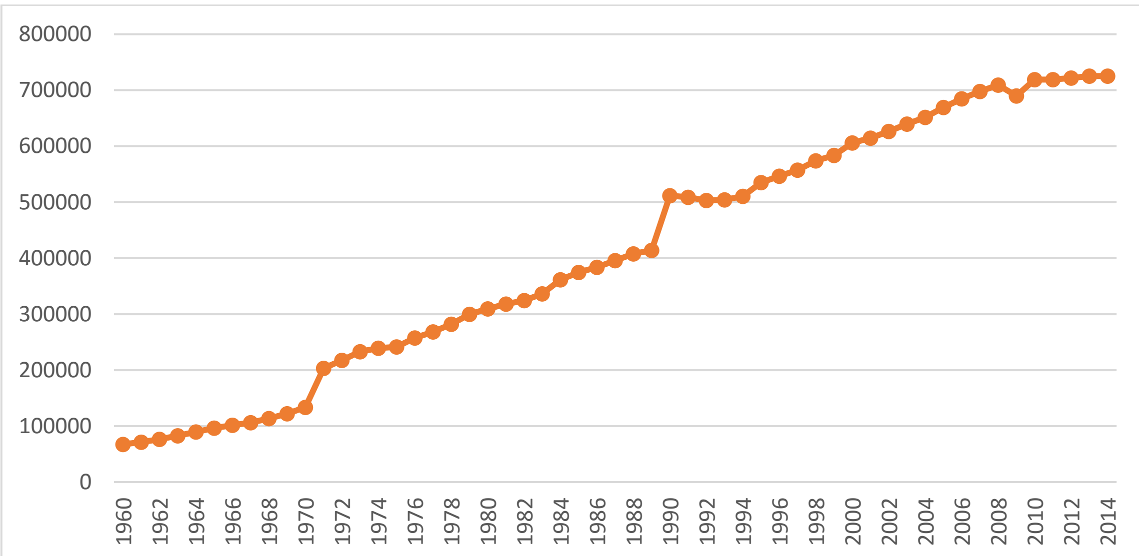

Figure 1.4 Electric power consumption (kWh per capita) [29]

Energy security plays a key role in environmental safety and development. The importance of energy has increased significantly in the context of the environment [30] as the relationship of energy systems with environmental protection, climate change, water security, global governance, and environmental politics[31], [32] has established the view that the 20th is about energy, then the century 21st is about energy governance and climate change.

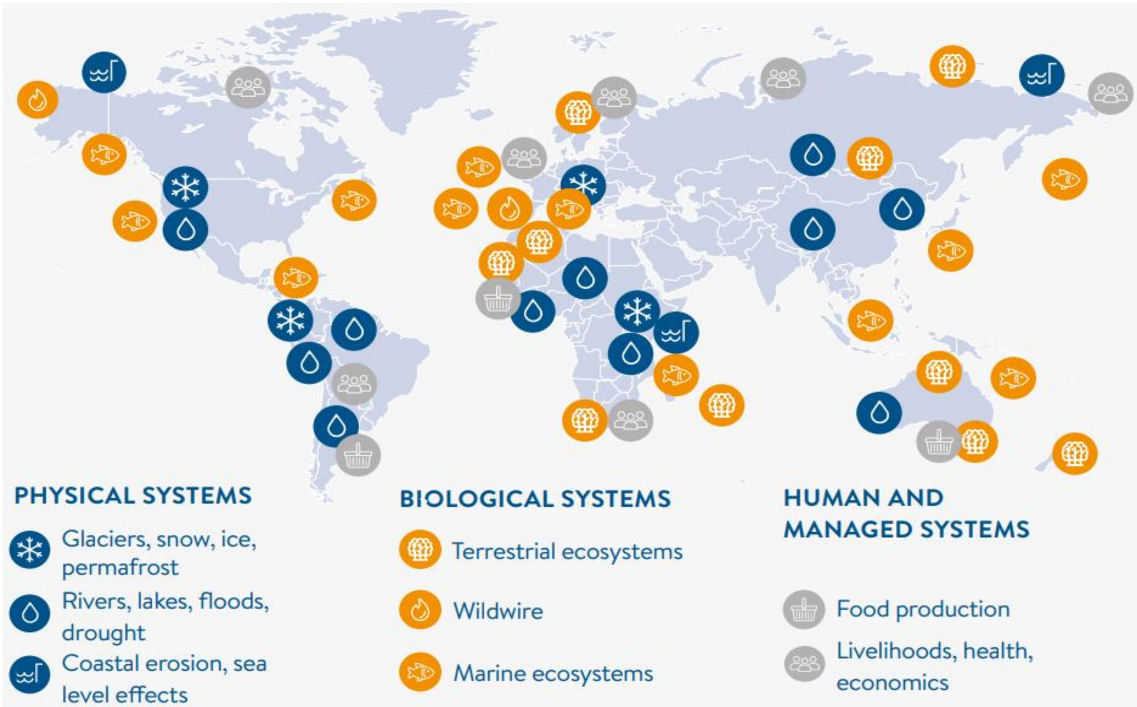

Figure 1.5 Major Observed Impacts Attributed to Climate Change [33]

Additionally, Sustainable Development Goal regulates collective efforts for the prosperity of human society and tray development [27]. SDG 7 has relied on access to energy that is given, is trustworthy, sustainable, and modern for all. In addition, winning goal besides including Poverty (Goal 1), food safety (Goal 2), air safety and sanitation (Goal 6), economic growth and development (Goal 8), the establishment of terrestrial ecosystems (Goal 15) global security (Goal 16) have been linked to this Goal[27]. SDG is devoted to the use of resources, investments and efficient efforts for global development after post-2015. Meanwhile, they will support a variety of basic cycle rankings including basic formulation (issues, goals, and vision), legal basis, use, use, and changes to legal environment safety and tray construction[34].

Due to an increase in global population and materialistic lifestyles, energy sources are rapidly diminishing. In addition, increasing the use of energy in the world also has bad implications for the natural surroundings and the earth's ecosystem. The use of fossil fuels for fuels is the main cause of the surrounding natural degradation. Increased use and demand for energy indicates that energy will be one of the main future problems in the world [35]. In industry, the increased use of fossil fuels and nitrogen steel has been stealing more greenhouse gases (GHG) into the atmosphere than any other process could have possibly done. It is very important to reduce the release of large amounts of carbon dioxide[36]. This stage has been budgeted at 450 ppm, which rises globally by 2 degrees Celsius in average soil temperatures [37]. Admittedly, the demand for energy in every sector of developed and underdeveloped countries is very important. Not denied, no country, at this time, can ask for a surprise without perpetuating requests and supplies in a tight manner. Therefore, to correct the shortage of energy and the increased pollution of the surrounding environment, the power source can free up now trusting the future to provide the world's energy demand. Each developed country and build its dependence on resources that must be approved to meet their needs.

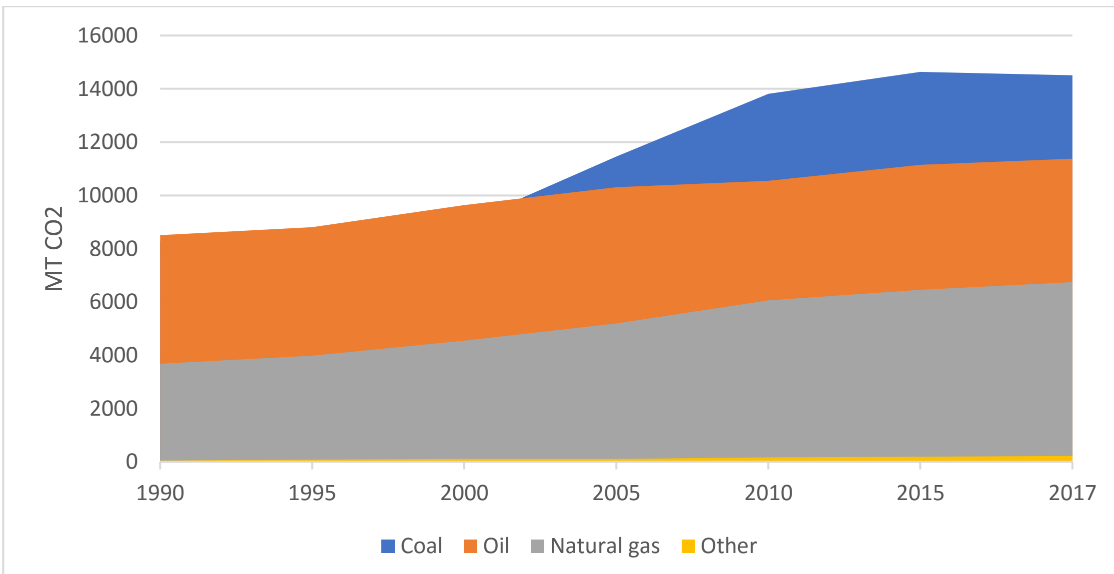

Figure 1.6 CO2 Emission by different sources [42]

Therefore, alternative and renewable energy endowments (AREs) are the hope for climate change to combat and ensure energy security through a diverse mix of energy [26]. Renewable energy growth is an effective, affordable, diverse, and practical choice because of its clean and renewable nature to guarantee future development, energy security, and environmental sustainability in the world[22], [38]–[40]. According to statistics, about 16% of global energy waste comes from renewable energy sources in 2010[41]. In addition, traditional power plants and traditional biomass for heating account for about 21 and 60%, respectively, in the use of world energy [42]. They reduce energy imports, environmental impacts of power plants, and trade deficits [43]. The Government has formulated and implemented the ARE policy and set the goal of using renewable resources. As such, it aims to promote ARE, accelerating market penetration and production quotas. It reduces costs, feeds rates; upgrade the update section; tax optimization; energy balance; reflect on environmental protection; reflects the political vision and economic development[44], [45].

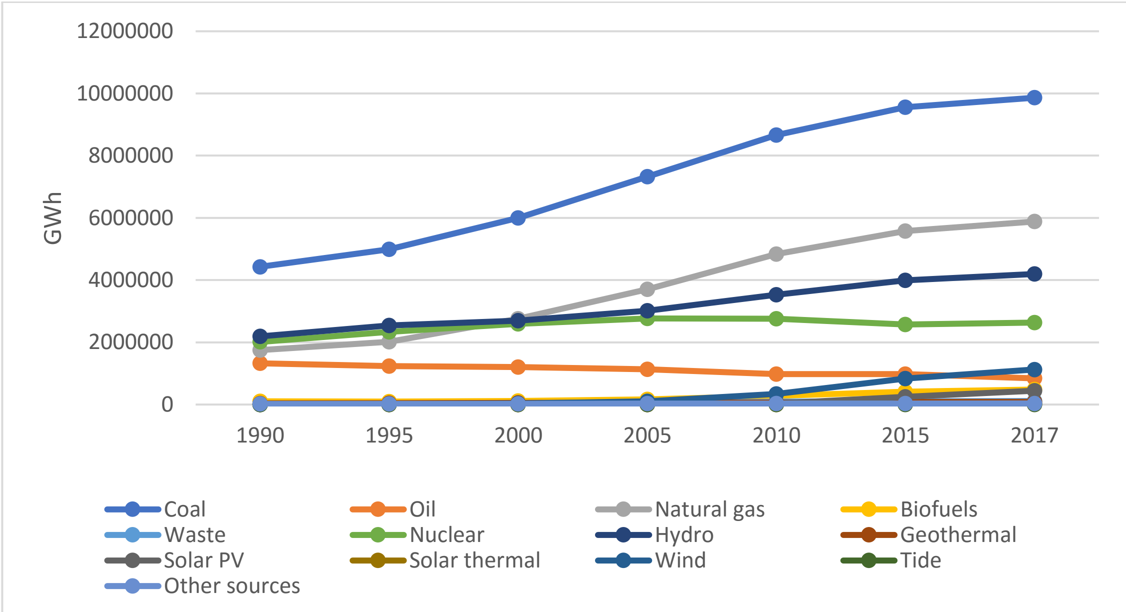

Figure 1.7 Electricity generation by source, World 1990-2017 [46]

1.2.Research Task Objectives

These renewal tasks discuss the basics used and lessons learned, unfolding signs of debate between different countries and the basics of RE in the world. This paper contains a comparative review and renewal of the permitted labor sector and a discussion of opportunities for employment. Exploitation of this partnership opportunity is needed to increase the economic development of the region. He will also contribute to global security and prosperity by meeting the needs of 40% of the world's energy. Our recommendation is to compare RES in Southeast Asia and explore opportunities to improve security in terms of security and shipping. This paper also includes the future and the future. In addition, work also extends the work sector Can be released from the latest data and graph analysis.

Literature review of reports, reports and papers about police supporting RE and the classification of various types of support (financial, financial, political, legislative and technological) is discussed in this document.

Through this study, the objectives followed can be achieved:

1. Have a comprehensive and up-to-date review of the various policies and mechanisms promoting RESS adopted worldwide.
2. To understand the reasons behind the success or failure of each policy and mechanism.
3. Learn lessons for future policy planning and development and mechanisms.

This report is organized as follows. Section 2 presents literature review and general trends of RE development, surveys and compares different international policies. Section 3 summarizes best practices and mathematical model. Section 4 is all about the result and further discussions on it. Finally, Section 5 concludes this study and opens discussion to the future challenges facing RE integration.

Summary

There is no uncertainty that the world's energy request has expanded considerably as of late by 1.3% and development is relied upon to arrive at 61% somewhere in the range of 2010 and 2040. So as to address this future hole between energy flexibly and request, just as to consider the dangers of worldwide environmental change because of ozone depleting substance discharges and different contaminations from unreasonable petroleum derivative ignition, much consideration was centered around sustainable power sources and productivity measures. Practical Development Goal controls aggregate endeavors for the flourishing of human culture and plate advancement. SDG 7 has depended on admittance to the energy that is given, is reliable, economical, and present-day for all. Moreover, winning objective other than including Poverty (Goal 1), sanitation (Goal 2), air wellbeing and disinfection (Goal 6), monetary development and improvement (Goal 8), the foundation of earthly biological systems (Goal 15) worldwide security (Goal 16) have been connected to this Goal. SDG is committed to the utilization of assets, speculations, and productive endeavors for worldwide advancement after post-2015. Environmentally friendly power development is a compelling, moderate, various, and handy decision due to its spotless and inexhaustible nature to ensure future turn of events, energy security, and ecological manageability on the planet. As indicated by insights, about 16% of worldwide energy squander originates from environmentally friendly power sources in 2010. Furthermore, customary force plants and conventional biomass for warming record for around 21 and 60%, separately, in the utilization of world energy. They decrease energy imports, ecological effects of intensity plants, and import/export imbalances. The Government has defined and actualized the ARE strategy and define the objective of utilizing inexhaustible assets. Thusly, it expects to advance ARE, quickening market entrance, and creation portions. It lessens costs, takes care of rates; redesign the update segment; charge enhancement; energy balance; consider natural insurance; mirrors the political vision and financial turn of events.

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CHAPTER 2

Literature Review

Technical considerations not only increase project duration and payment period but also reduce costs, emissions, environmental insecurity, and the impact of climate change.[1] It define efficiency in terms of how much useful energy is generated from high reliability and low cost endowment sources. The International Energy Agency estimates that the market for energy efficiency is booming due to its understanding of value, rising energy demand, global growth aspirations, the need to limit emissions, and climate change and technologically advanced projects [2]. Although maturity is a measure of how widely used technologies are nationally and internationally [3], the key criteria for energy policy [4] are improving project reliability [5] define reliability as the ability to fail without a disaster under certain conditions for a certain period of time, but the security of energy systems can reduce the effects of disasters. Therefore, the security of energy systems is becoming more important as regulatory, technology and public safety changes. This is a combination of related disciplines including reliability, quality, durability, availability, and sustainability of energy systems [6].

The economy of the ordinary labor system is for labor projects and is the basis for providing stock and escorting boarding. If you have a direct relationship with the benefits, go up and down loan rates, go up, change grounds, and go up in developing countries [7]. However, operations value products, workers' wages, labor costs for the operation of the labor system, and the use of funds for labor, administrative costs to avoid failure, which will increase the hanging operation and improve the labor system for life[3]. Operations and operations play an important role in making and decision-making to develop in developing countries by an unstable economy, changes in tariffs, high changes, and beneficial levels [7]. As with different boarding costs, the net present value is the most important criterion for investment in projects, uses, escorts, and a basic system of labor [8]. This is a standardized method for the whole economy, deficits or more, caj flow, spending, future value for assessing long-term labor projects and payback [3]. Employee payback periods are the number of origin investments, return to community power, and technological achievements that differ towards sustainability and capability [9]. Non-conformity is considered as the main foundation of modern, SDG, work safety, approval, permissiveness and sustainability [10], [11]. Mismatches can be increased by several subsidies and incentives which should also motivate traders, provide energy checks to users, and pro-mote green power [12].

In addition to the technical and economic aspects, the environmental aspect is one of the agendas emerging in developed energy policies due to the negative effects of energy systems on environmental security. The global energy sector mainly contributes to fossil fuels and accounts for 87% of global energy use, resulting in devastating environmental impacts According to the basic case scenario, greenhouse gas emissions from Pakistan's energy sector will increase by 9x (1.543 million tons) by 2050. CO2 emissions will lead to scenarios followed by SO2, NOx, particles (PM), CO, and methane [13]. Increased emission levels threaten environmental safety and long-term development. This requires special attention on COx, NOx, SOx and PM, methane, and volatile organic compounds [13]–[16]. Therefore, it is appropriate to consider environmental aspects and greenhouse gas emissions in Pakistan's energy policy [13]. The energy base must determine the criteria, types, and uses of the land In addition to emissions, increasing energy - water - climate change has been the concern of energy policy makers. Presumably, all phases of the energy cycle including extraction and mining, cooling on thermal power plants, biofuel crop irrigation, and waterpower plants are highly dependent on water use. Similarly, all phases of water supply include energy extraction, pumping, cleaning, desalination, and energy-dependent distribution[18]. World power plants accounted for 583 billion cubic meters (15%) of total global water output in 2010, of which about 66 billion cubic meters (10%) were used In addition, energy and water availability are updated by climate change seeking a similar global effort [18], [20]. The UN SDG reflects the increasing economic and industrial development, international political and environmental, water security, affordability, and energy accessible to all [21]. Therefore, better policy coherence in the energy and water sectors and other goals is imperative to sustainable and future development [22].

The social aspect has contributed to the glory of the new power development paradigm. One paradigm of labor development fosters partnership between private and state agencies led by the community because of investment funds, economic efficiency, natural uncertainty, and a global power based agenda[23]. Concerning interested parties in the power base and their needs and interests, which has increased the mediation of social acceptance on a labor base It varies by virtue, interests, and sources of different actors, influences, and points of view. Stakeholders include individual groups, communities, local authorities, kingdoms, investors and academic institutions [25]. An inclusive decision-making process through participatory discourse fosters stakeholder complaints, better social impressions, a sense of ownership and empowerment. Ownership and inclusion are the main ingredients of development that triumph over economic development experts [26]. Social benefits in a basic framework that not only provides guarantees (financial and not community) for the community but also guarantees cooperation at every level. Social benefits include partnership results, work, a better set of local roads, and other lay services [27]. The transition of a capable green power, efforts to replace change and achieve environmental sustainability according to the request and cooperation of all interested parties [28]. It can be made from the discussion above that for multi criteria-analysis including technical, economic, natural environment and social aspects is the core for an impressive power base, a smooth transition of green power, safety of the natural environment, and development. It is clear from the above discussion that the multi-criteria technique that is used for many workers throughout the world and backs up the practical basic implications that have played an important role in assisting green energy. However, fewer studies from Pakistan have discussed several criteria, but include a rigorous gap in a detailed analysis of the power base in Pakistan to obtain a robust green power. Therefore, this study has connected the knowledge of registrants needed to match this gap and to reserve a basic implementation for future implementation and a basic green power base.

2.1. Global Energy Trend

In 2017, global electricity production rose 2.5% to reach 25721 TWh. In terms of production, flammable fuels account for 66.8% of the world's total gross production (comprising: 64.5% of fossil fuels; 2.3% of biofuels and waste), water power plants: 16, 3%; nuclear power plants: 10.2%; wind: 4.4%; solar: 1.8%; and geothermal sources, tides, and more: 0.5%[29].

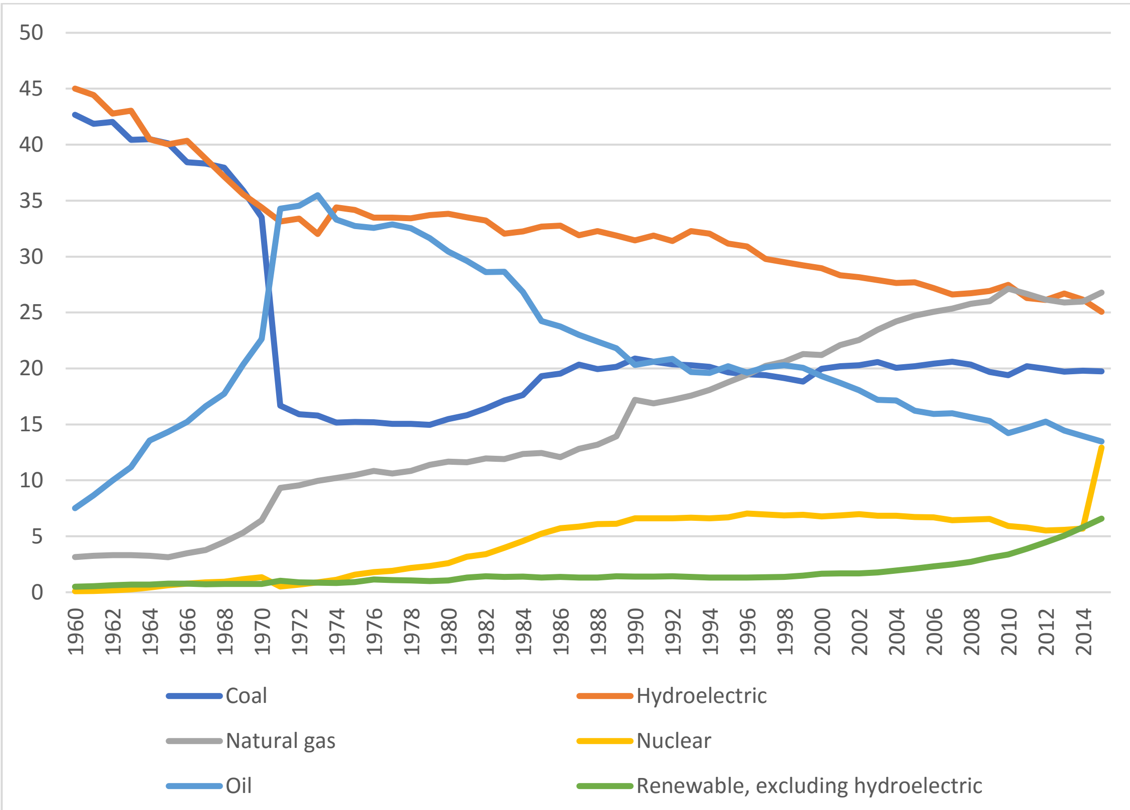

Figure 2.1 Electricity production from all sources till 2015 [30]

Globally, the countries that use the largest electricity are the People's Republic of China (25.9%) and the United States (17.5%), which together account for more than 40% of global users. This was followed by India (5.4%), Japan (4.5%), Russian Alliance (3.6%), Korea (2.4%), Germany (2.4%), Canada (2.4%), Brazil (2.3% (2.0%). Overall, the countries that rank the top account for more than two-thirds of global electricity use[29].

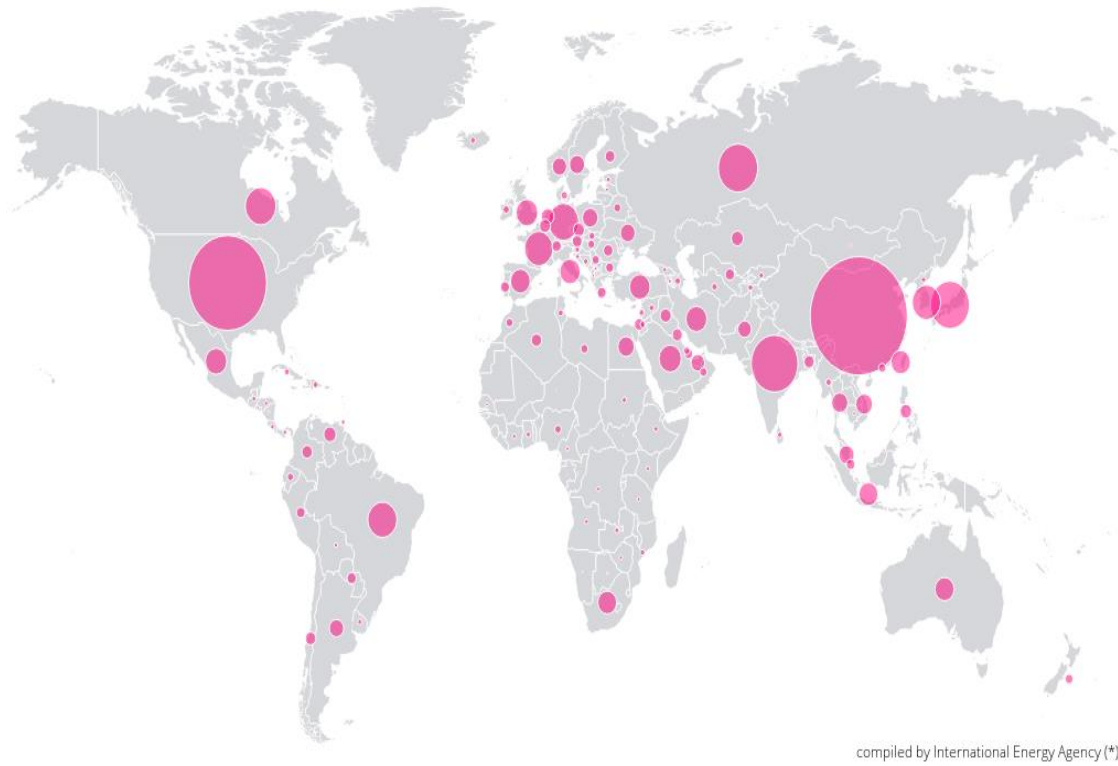

Figure 2.2 Electricity Production 2017 [31]

However, the ranking is significantly different in terms of electricity consumption per capita. This is because the level of electrification, equipment penetration, market saturation, and electrical heating or cooling requirements have a significant impact on per capita consumption. For example, while India ranks third in the world in terms of total electricity consumption, it is relatively low in terms of electricity consumption per capita[29].

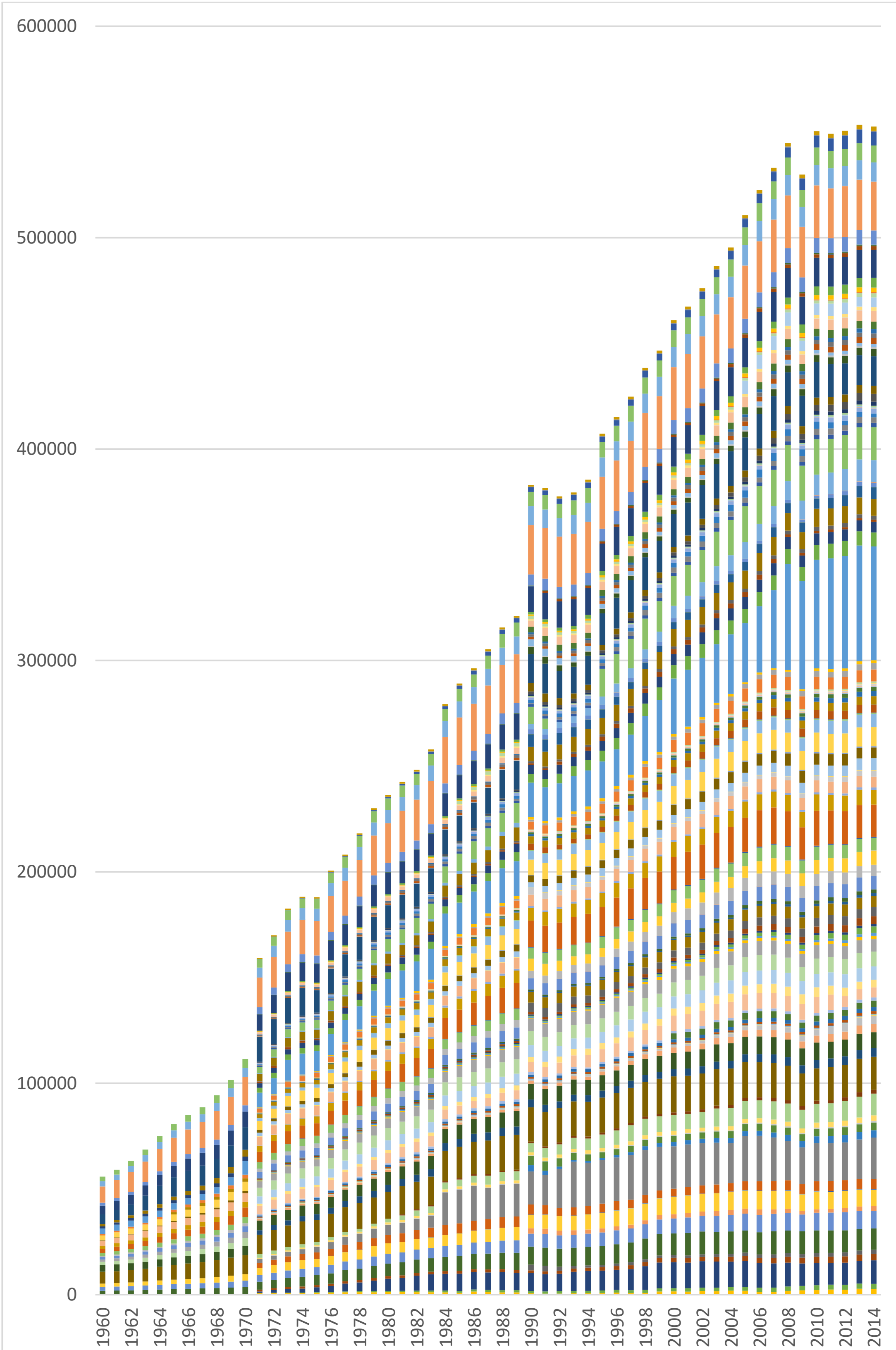

Figure 2.3 Electric power consumption (kWh per capita) of all countries till 2014 [32]

Aruba
Albania
United Arab Emirates
American Samoa
Austria
Belgium
Bangladesh
Bahamas, The
Belize
Brazil
Bhutan
Canada
Channel Islands
Cote d'Ivoire
Congo, Rep.
Cabo Verde
Cuba
Cyprus
Djibouti
Dominican Republic
Early-demographic dividend
Europe & Central Asia
Euro area
Estonia
Angola
Arab World
Armenia
Australia
Burundi
Burkina Faso
Bahrain
Belarus
Bolivia
Brunei Darussalam
Central African Republic
Switzerland
China
Congo, Dem. Rep.
Comoros
Caribbean small states
Cayman Islands
Germany
Denmark
East Asia & Pacific
Europe & Central Asia
Egypt, Arab Rep.
Spain
European Union
France
Gabon
Ghana
Gambia, The
Greece
Guatemala
High income
Hungary
IDA total
IDA only
Not classified
Afghanistan
Andorra
Argentina
Antigua and Barbuda
Azerbaijan
Benin
Bulgaria
Bosnia and Herzegovina
Bermuda
Barbados
Botswana
Central Europe and the Baltics
Chile
Cameroon
Colombia
Costa Rica
Curacao
Czech Republic
Dominica
Algeria
East Asia & Pacific
Ecuador
Eritrea
Ethiopia
Fiji
Micronesia, Fed. Sts.
Georgia
Guinea
Equatorial Guinea
Greenland
Guyana
Honduras
Haiti
IDA & IBRD total
Indonesia
India
Iran, Islamic Rep.
Israel
Jordan
Kenya
Kiribati
Kuwait
Lebanon
St. Lucia
Low income
Lower middle income
Late-demographic dividend
Latvia
Finland
Faroe Islands
United Kingdom
Gibraltar
Guinea-Bissau
Grenada
Guam
Hong Kong SAR, China
Croatia
IBRD only
IDA blend
Kazakhstan
Cambodia
Korea, Rep.
Lao PDR
Libya
Least developed countries
Sri Lanka
Lesotho
Luxembourg
Moldova
Middle East & North Africa
Middle income
Malta
Montenegro
Mozambique
Malawi
Namibia
Nigeria
Norway
New Zealand
Other small states
Madagascar
Mexico
North Macedonia
Myanmar
Mongolia
St. Kitts and Nevis
Latin America & Caribbean
Liberia
Latin America & Caribbean
Liechtenstein
Low & middle income
Lithuania
Monaco
Maldives
Marshall Islands
Mali
Middle East & North Africa
Northern Mariana Islands
Mauritius
North America
Niger
Netherlands
Nauru
Oman
Panama
Malaysia
New Caledonia
Nicaragua
Nepal
OECD members
Pakistan
Japan
Kyrgyz Republic
Iraq
Italy
Isle of Man
Ireland
Iceland

Legend - Electric power consumption (kWh per capita) of all countries till 2014 [32]

The past decade has witnessed steadfast growth in the use of technology that can be approved, with the sector leading the way thanks to increased cost thanks to solar photovoltaic (PV) and wind power. Even though more labor must be spent in the end use sector such as industry and buildings[33].

Electrical scheduling from 2018 with spending being 450 terawatt-hours (TWh) (or 7%) compared to the previous year, contributing more than one separate place according to the number of energy guarantees. Producing output from solar PV, wind and hydro contributed 90% of the increase. The approved capacity of the 180s guaranteed around 180 gigawatts (GW) has been added in 2018, which is the same result the previous year, according to the IEA budget for 2019, which reserved the initial growth of firm growth in areas that can be supported as expected[33].

Cost reduction in the development and improvement in digital technology Wind and solar PV provides more than 2040 in Placed Basic Scenarios and all growth in the Tray Development Scenarios [33].

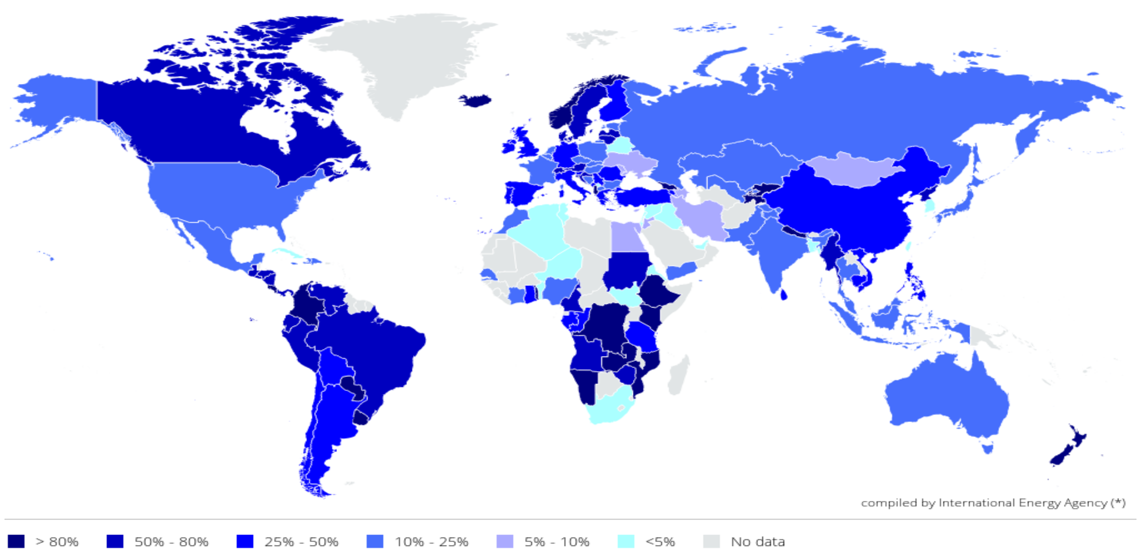

Figure 2.4 Renewable Energy Production 2017 [31]

In the Stated Policy Scenario, the amount of renewable energy (excluding traditional biomass use) in end use increased from over 990 mto today to nearly 2260 mto by 2040. The share of renewable global warming increased by 60% and reached nearly 940 by 2040, thanks to huge growth in the use of modern bioenergy (boilers and kitchens, biogas and bio-methane, biofuels), renewable energy and even sunlight. Meanwhile, the contribution of renewable energy to three transport sectors is around 300 Mtoe, three of which come from bio fuels[33].

In the Sustainable Development Scenario, additional steps to invest in renewable energy-based, bioenergy, solar, geothermal and electrification-based energy drives the latest segment to two-thirds of power plants and 37% of final energy consumption. By 2040, the expected output of wind (8 300 TWh) and solar PV (7 200 TWh) is expected to exceed water (6 950 TWh), while heat output derived from renewable energy by 2040 will increase to 30% from total or 1,200 mtoes. In the transportation sector, energy consumption from renewable sources is estimated to increase to 600 mtoes, with biofuel contributing about 60% and electricity from renewable sources used by electric vehicles and rail connections for the rest[33].

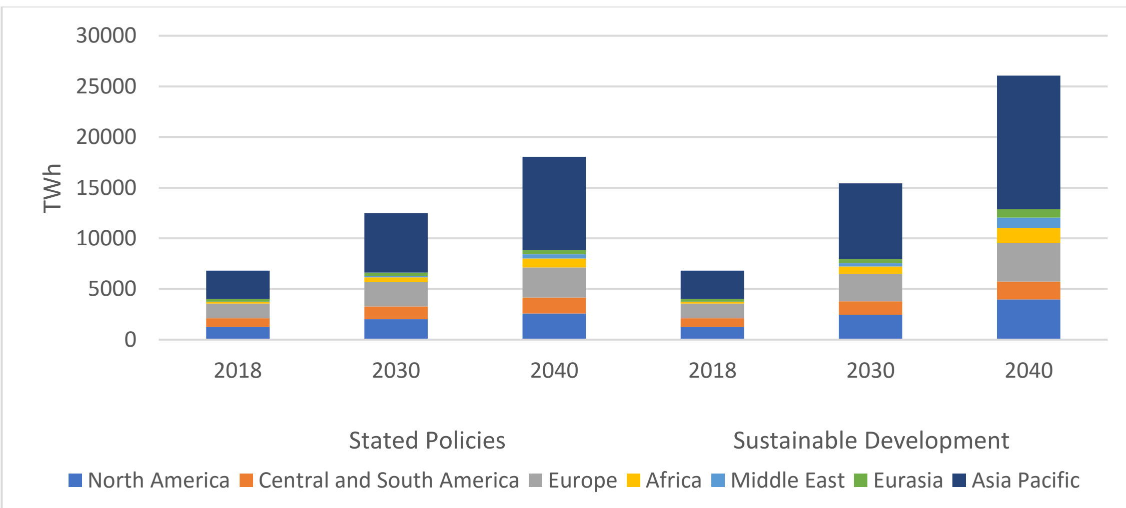

Figure 2.5 Renewable electricity generation by region and scenario, 2018-2040 [34]

In the Stated Policy Scenario, nearly 8 500 GW of new capacities were added globally by 2040, of which two thirds must be approved. Update additional costs for capacity in most areas. This includes about 80% needed in the European Union and China, but they provide less than half of Southeast Asia and the Middle East. Solar PV provides the largest portion of capacities that can be approved in most regions, including China and India[33].

In the Sustainable Development Scenarios, approximately 80% obtain capacities in all regions, mainly propagated by nuclear power and carbon capture technology [33].

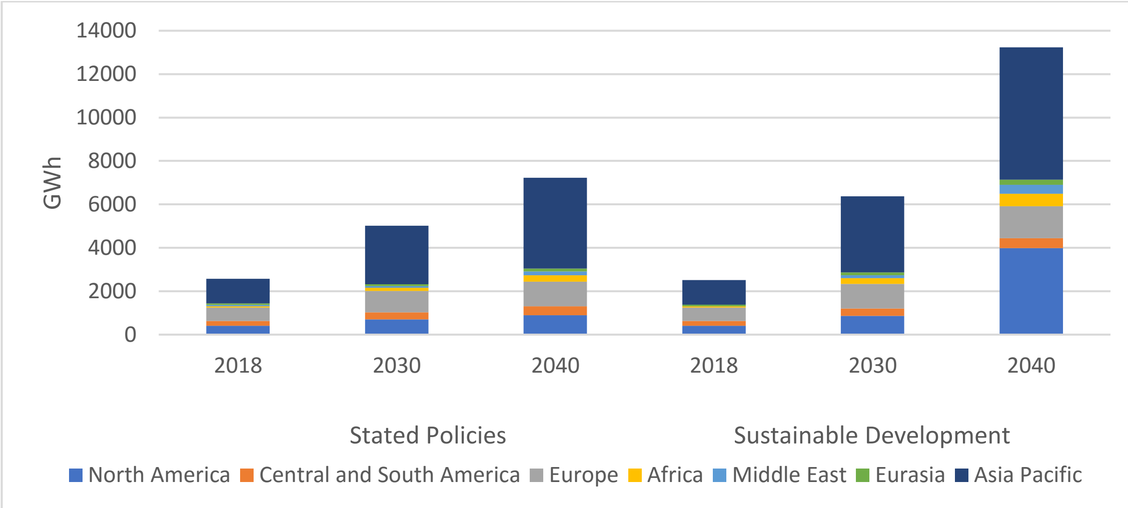

Figure 2.6 Renewable electricity capacity by region and scenario, 2018-2040 [34]

Renewal-based electricity investment dropped slightly in 2018 to around $ 390 billion but renewed costs continue to buy more capacity than ever before. In one of the following world scenarios, investment in emerging technologies should be accelerated[33].

In the Explained Policy Scenario, renewable energy investments reach a cumulative sum of between now and 2040 at about $ 10 trillion. In the Sustainable Development Scenario, investment is growing faster, reflecting stronger policy support and the key role that this clean energy technology plays in achieving sustainable energy goals[33].

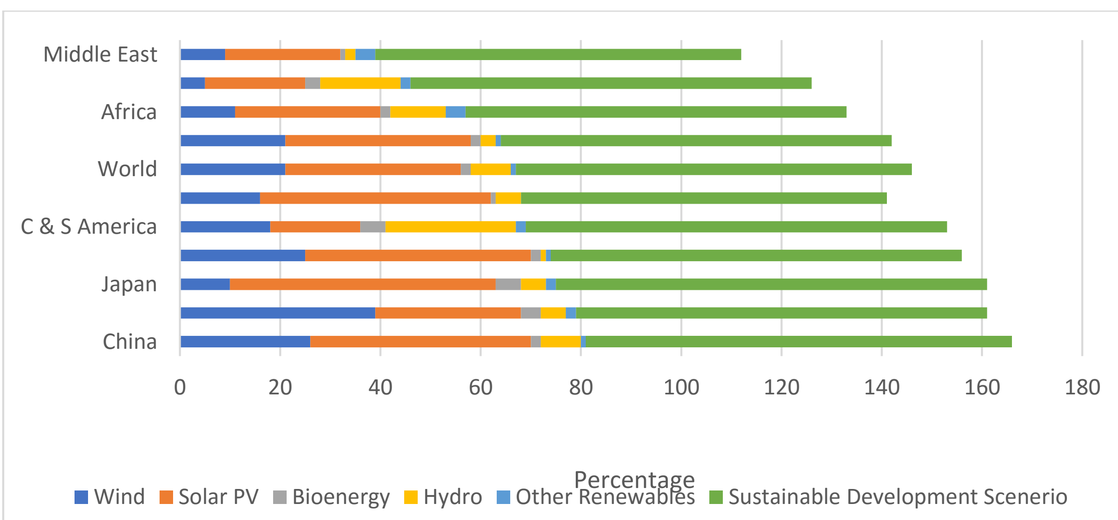

Figure 2.7 Renewables share in capacity additions by region in the Stated Policies and Sustainable Development scenarios, 2019-2040 [34]

Coastal outdoor winds have the technical potential to meet today's electrical demand. It is a different source of change, but Coastal outer winds offer a higher capacity factor than solar PV and terrestrial winds thanks to larger turbines that utilize higher and more reliable wind speeds far from shore. Innovations are available at the horizon, including floating turbines that can be opened and new markets[33].

The increasingly competitive Coastal Outer Wind Project is expected to attract a trillion dollars of investment to 2040. The European triumph with technology has sparked interest in China, the United States and elsewhere. In the Development Tray, the Coastal Outer Wind binds his colleague as a source of advancing electrical financing in the European Union, paving the way for the free sector's dismissal to support Europe. In fact, higher use is possible if Coastal outside winds become the principle for hydrogen carbon[33].

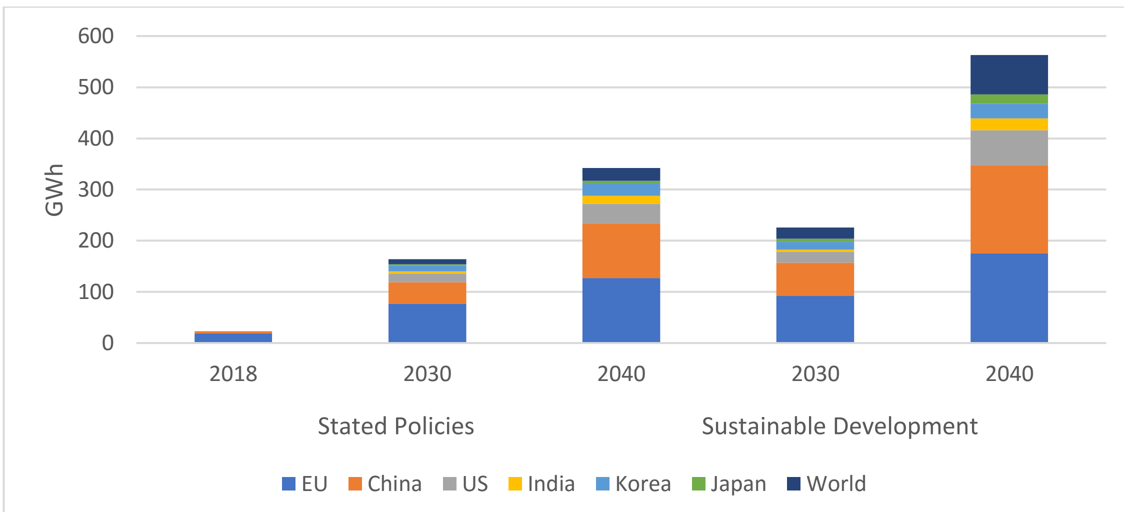

Figure 2.8 Installed capacity of offshore wind by region and scenario, 2018-2040 [34]

While technology for producing biogas is not new, there has been interest in its potential in recent years. IEA analysis shows that more than 570 Mtoes of biogas per year can be produced continuously today, equivalent to almost 20% of global natural gas demand. New economies are emerging for two-thirds of global biogas potential. However, biogas everywhere needs a support policy if it is to be fully utilized[33].

The benefits of using biogas are enormous and the economic case is significantly enhanced if these non-economic benefits are fully accounted for. In the Designated Scenario, nearly 150 Mt biogas is produced globally by 2040, more than 40% of which is in China and India. In the Sustainable Development Scenario, there is a significant increase in biogas production: it will reach around 330 Mt by 2040, using about 40% of its overall technical potential[33].

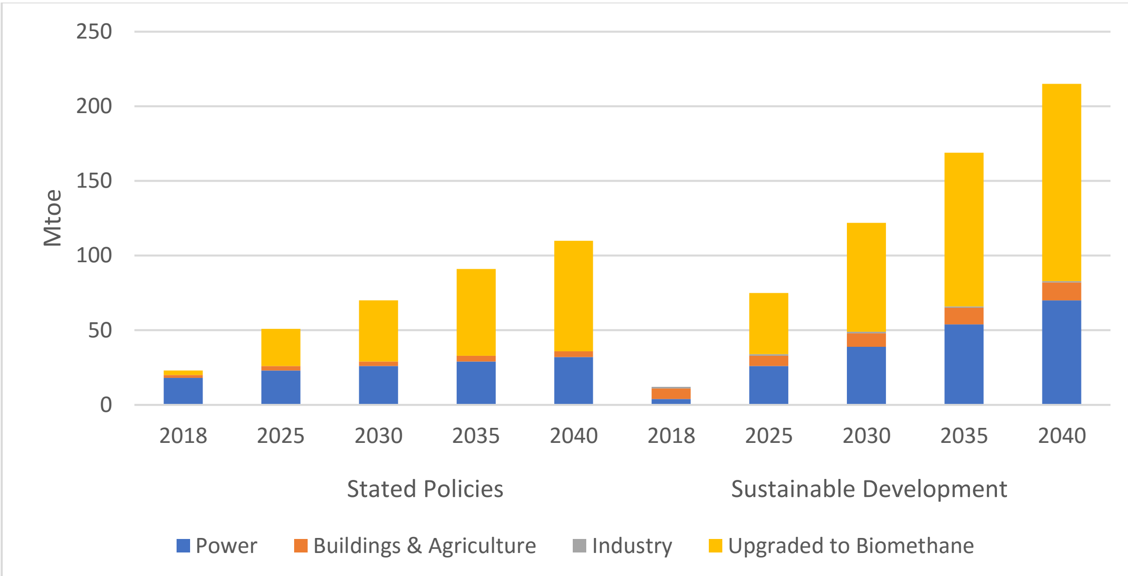

Figure 2.9 Global biogas demand in the Sustainable Development Scenario, 2018-2040 [34]

2.1.1. Major Projects

The energy that can be expended is the fastest growing sector in the entire world. Seeing the need to increase clean and sustainable power, and technology that can support going forward, more and more projects are being built up in size and greater complexity.

1. Hornsea Project 2

Danish company Ørsted has been developing Hornsea Project 2 since August 2015. It aims to become part of the larger Hornsea Zone, located 89 km off the East Riding coast of Yorkshire. This is an offshore wind project costing $ 7.8 billion, 165 turbines will be installed in water depths of between 30m and 40m, with 204m and 8,000 kW of nominal power, together they will have a capacity of 1.386MW, farm will be connected to the network at the North Killingholme North Grid transmission station in North Lincolnshire, online cable construction begins in 2019, with wind farm sites including installation of

HVAC stations, reactive compensation stations and foundations beginning in 2020. Cable installation and turbine installation will begin in early 2021, for early next year[36].

Figure 2.10 Horrnsea Project 2 [35]

2. Ghana Wave Power Project

Seabased Energy has been contracted by TC Energy to develop wave power with a total capacity of 100 MW outside the coast of Ada, Ghana, the project was designed for several years, with a pioneering phase of 1MW installed by Sweden Energy in May 2015. There are still several wave technologies used throughout the world, and this is made one of the largest wave drive projects with a $ 7.5 billion fee, the park will use a series of buoys that are connected to a linear guard as a wave power exchanger (WEC). The power generated by the movement of the Switchgear buoy makes it electrically suitable for grid use, according to Seabased, a 100MW lodge can be electric for thousands of Ghanaian homes, sustainable and clean. Apart from not releasing any release, the wave park creates artificial reefs for marine life, the seabed is contracted to form, remove and install refineries, which will be moved by TC Energy. The expected project will be given this year[36].

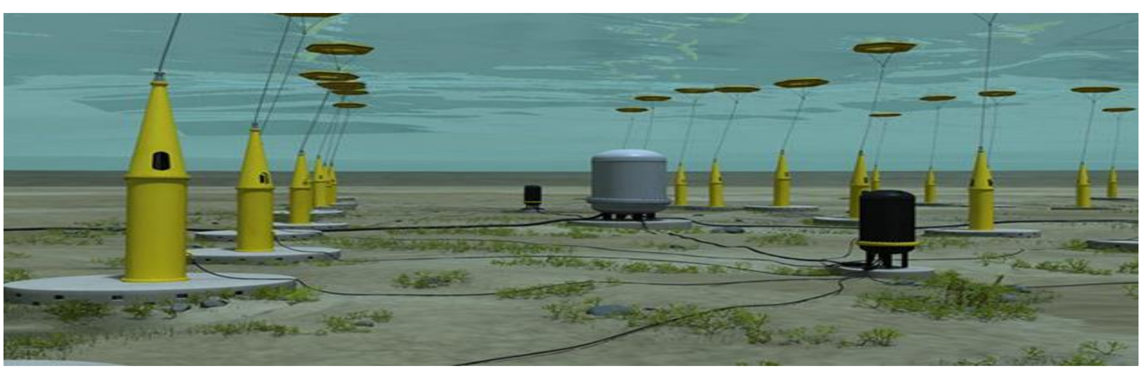

Figure 2.11 Ghana Wave Power Project [35]

3. Ulanqab Wind Farm

The largest inland wind farm in the world will cover 3,800 sq km of Northern Mongolia Autonomous Region in North China. Ulanqab's 6GW wind farm aims to deliver 18.9 billion kWh per year to the Beijing-Tianjin-Hebei electricity market and is said to help win the 2022 Winter Olympics, construction began in 2018 by China State Power Investment Corporation (SPIC) which exclusively contracted domestic companies for $ 6.2 billion worth of work. The construction is taking place gradually, each capable of producing 100MW up to 200MW. Each turbine will have an average power capacity of 4.16MW, the project is not subsidized by the government, but will benefit from a number of actions including a 20-year power purchase agreement, a waiver of local content requirements and secure network connections. It is expected to start giving power this year[36].

Figure 2.12 Ulanqab Wind Farm [35]

4. Leh and Kargil Solar Power Projects

Three individuals formed the 7.5GW Syria project in the Leh and Kargil regions of Jammu and Kashmir. Each phase will have 2,500 MW with 5,000 MW built in the Pang Leh region and 2,500 MW in the Zangla Kargil region with a cost of $ 6 billion, approved high-altitude Himalayan regions have great potential for solar rulings. The designed project will connect to the delivery circuit which was launched 850km to Punjab, "MNRE (Ministry of New and Renewable Labor) requests to complete labor projects with cumulative capacities of around 14 MW (megawatts) with capacity savings of 42 MWh batteries (megawatt-hours) in Leh and Kargil," said RK Singh, Minister of Labor Power and New & May Be Updated when announcing the project, requests for elections have been announced in 2019, with bids to be submitted before 31hb January 2020. Coaching will begin after the tender has been earmarked[36].

Figure 2.13 Leh and Kargil Solar Power Projects [35]

Part of the $ 13.6 billion Mohammed bin Rashid al Maktoum Solar Park in Dubai, based in the Dubai desert, phase IV will be the first phase of centralized solar power - with the previous three using photovoltaic panels, phase IV alone will have a total capacity of 950MW, divided into 700MW of CSP technology and 250MW of PV, for $ 4,295 billion, it will be the world's tallest salt tower factory, standing 260 meters high and receiving sunlight focused from heliostatic mirrors to power steam turbines, generating 100 MW of power. In addition, three hot oil parabola plants will each contribute 200MW, the 250 MW photovoltaic plant will form the remainder of Phase IV, construction is underway with commissioning expected gradually - with the first coming this year. Phase IV is expected to be completed by April 2022, while Mohammed bin Rashid al-Maktoum's Solar Solar is expected to be fully operational as the world's largest solar park by 2030[36].

Figure 2.14 Mohammed bin Rashid al-Maktoum Solar Park Phase IV [35]

5. Shek Kwu Chau Energy from Waste

As one of the most populous cities in the world, Hong Kong generates large amounts, and requests large amounts. The Environmental Protection Position (EPD) seeks to solve two problems with one stone through coaching comfort in integrated management (IWMF) on a redeemed island on the Shek Kwu Chau beach - one of the small islands in the region, far from the tourist areas of the metropolitan area, this will include a large incinerator that is recommended to be treated 3,000 tons daily at peak operations. He also included a mechanical maintenance lodge, an administration building, a travel center, set up a harbor and water treatment and underground water treatment lodge with a cost of $ 4 billion, according to the project leader, the project will produce enough energy to control more than 100,000 homes in Hong Kong, while reducing meeting on the available escape site. He is expected to realize the work through a coaching process that requires the addition of land, infrastructure works, buildings and maritime engineering. The main acquisition and printing work in addition to providing land for fish ponding work is expected this year[36].

Figure 2.15 Shek Kwu Chau Energy from Waste [35]

6. Tengger Desert Solar Park – China

China has more solar power than any other country in the world, thanks to its resources and commitment to clean energy. After years of dependence on other sources of energy, with solar power being considered "too expensive" in the country recently in 2012, the Chinese government has changed its policy. They have promised to fulfill the objectives of the Paris Climate Change Agreement and pledge to spend $ 360 billion on renewable energy by 2020 - creating 13 million jobs in the process, thus, they expect that by 2030 China will draw 20% of its power from renewable sources. However, so far only solar energy has met 1% of current demand. To this end, China uses a vast desert that covers about 20% of the country, series of large-scale facilities are under construction across China, including the world's largest Solar Desert Bridge, often referred to as the "Great Wall of the Sun," the large plant covers an area of 43km2. It is located in an open desert over 1,200 km2 near Zhongwei in the North Ningxia region of China, these developments have benefited from the low cost of photovoltaic panel production in recent years. With 60% of the world's largest solar panels made in China, the country is at the forefront of technology, the park is growing, but according to recent reports, it now has more than 20 integrated photovoltaic plants, producing up to 1,547 megawatts - more than any other solar power plant in the world[37].

Figure 2.16 Tengger Desert Solar Park – China [37]

7. Ivanpah Solar Facility – USA

Three lodges have to be removed 14.2km2 of diesel from California / Nevada Sempadan in the Mojave Desert.

Plants use a built-in solar system built by BrightSource. The mirror ring is escorted by sunlight to the 459-foot tower that sits in the middle. This intense sunlight heats the air that is stored at the top of the tower to produce steam, from there the system works like a traditional januese lodge. The wap is distributed from the boiler to turn on the turbine and maintain electricity. The delivery line then brought him carrying more than 140,000 homes each year throughout California, 300,000 mirrors are used between three units, each measuring 10 feet wide by 7 feet high. They need to move perfectly to maximize energy focus, so that every movement is directed to impress the sun throughout the day. The development of this project took three years, starting in October 2010 and ending in December 2013, and at its peak involved 2,636 coaching workers and support staff, together with these three fields can produce up to 392MW in power. The same capacity of fossil lodges will be released so that 400,000 metric tons of carbon dioxide increase. It also uses a dry cooling process that uses air and uses air to shorten the steam, in a closed coil system that uses a permit of 95% less air than other solar systems[37].

Figure 2.17 Ivanpah Solar Facility – USA [37]

8. Sihwa Lake Tidal Power Station - South Korea

Along the South Coast of South Korea, 43.8km2 from Lake Sihwa was built using a 12.7 km long sea wall in Gyeonggi Bay in 1994 as part of a land reclamation project. Water gates in seawater are regularly open to distribute seawater and prevent contamination in the lake, the Tidal Power Station was built in 2004, operating in 2011, to use the current flow. This station has the added bonus of helping to increase water circulation by up to 200%, ten 25.4 MW submerged tubes were rotated with running water from the West Sea twice during the day. When water waves flow through the gate, it separates the lake to the lowest level, tidal lines are the world's largest tidal power installation and cost $ 560 million to build. It produces 552.7 GWh of power annually enough to power 500,000 cities. The equivalent output of an oil-powered station will produce 315,000 tons of CO_2[37].

Figure 2.18 Sihwa Lake Tidal Power Station - South Korea [37]

9. The Geysers – California

115km north of San Francisco, in the middle of the Mayacamas Mountains, is a geothermal field known as The Geyser, covering 30km2 (45 square stones) along the Sonoma and Lake County borders, this is a stimulation field originally created that is linked to a large magma chamber containing four rocks beneath the surface and includes eight stone diameters. The broken and dead rock around this room allows air to get close enough to the magma to heat up and turn into stimulation, which is returned to the surface, power companies such as Calpine have used this phenomenon to realize the largest geothermal January lodge in the world. 22 is conveniently located in the field, attracting steam from over 350 wells, 19 of these plants are owned by Calpine, one by the US Renewable Group (USRG) and tray two which is owned by the Northern California Power Agency (NCPA) and Silicon Valley Power, the first geothermal lake was drilled in 1921 and produced 250KW of electricity. Now this field increases the amount of authority capacity by 1517MW, generating 60% of the demand for shoreline requests between the Golden Gate Bridge and the Oregon state line [37].

Figure 2.19 The Geysers - California [37]

Table 2.1 Global annual average investment in renewables by scenario (billion USD 2018) [38]

	Stated policies			**Sustainable Development**		**Change 2018 vs 2031-2040**	
	2018	2019-30	2031-40	2019-30	2031-40	STEPS	SDS
Renewables based Power Generation	304	329	378	528	636	24%	109%
Wind	89	111	122	180	223	37%	151%
Solar PV	135	116	125	179	191	-7%	41%
End use sectors	25	117	139	124	145	456%	480%
Total	**329**	456	**517**	**652**	**781**	**57%**	**137%**

2.2. Energy Trend in Pakistan

The quantity and quality of energy determine the economic viability of a country. Quantity refers to the supply of energy that sustains demand because quality refers to the energy source from both conventional fossil fuels and from renewable and sustainable energy sources. Due to the industrial industry and population growth of the population in Pakistan cannot meet energy demand[39][44]. In the early years of its existence, Pakistan focused on waterpower and met all the energy and irrigation demands of the country's abundant waterpower. Until 1994 Water and Electricity Development Authority (WAPDA) was the only power producer in the country but after the 1994 energy policy[40], [41]. Independent Power Producers (IPPs) started working and installed thermal power plants that operated on conventional fossil fuels as they followed the "dash for gas" phenomenon for the immediate benefit of oil and gas power plants[39]. Under the 1994 energy policy, the Private Institution & Private Infrastructure (PPIB) was established to facilitate IPPs as one-window organizers [40], [41]. The incentives provided to IPPs attract various investors who install heat generators . Each year, renewable energy policies facilitate IPPs. Important features of some energy policies are highlighted in Table 3.1 [40]–[42].

Introduction of IPPs in Pakistan's power structure exponentially increases electricity prices and diverts energy from hydro to heat but inadequate supply gap of nearly 6000 MW [39]–[43] cannot be eliminated as shown in Figure 2.20 [44] for the past five years. Pakistan's energy mix on June 31, 2015 is shown in Table 2.2. In 2006, the Renewable Energy Policy (REP) was announced to introduce renewable energy sources in the energy mix to support the energy sector [42]. Prior to REP 2006, the Alternative Energy Development Council (AEDB) was formed in 2003 to act as a window facilitator for renewable energy IPPs [45]. The AEDB is actively implementing REP 2006 and manages a range of renewable energy projects in the fields of wind, sun, biomass, and biogas as described in the next section.

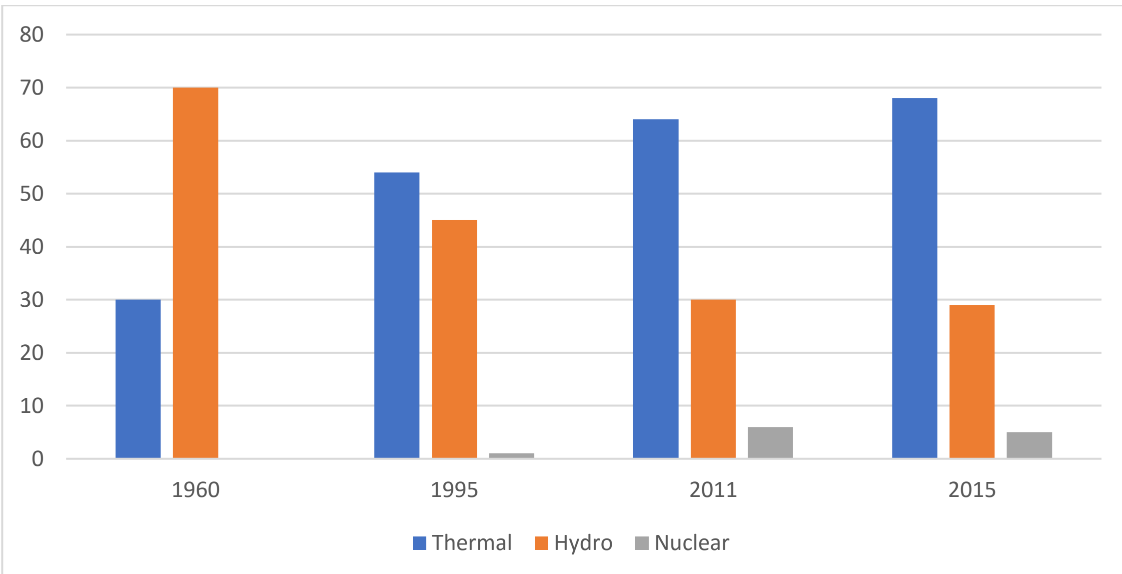

Figure 2.20 Transition of energy mix from hydro to thermal 1960-2015 [46]

The most important step in the balance of Pakistani Power is the amount of 92.33 billion kWh electricity usage increased. This per capita is a mean of 435 kWh [46].

Pakistan may provide it entirely with self-produced power. 110,000 more are using electric power producers, 119% of their own needs. The rest of the energy produced by itself is exported to other countries or not used. Together with genuine published use, imports and exports play an important role. Other energy sources such as natural gas or crude oil are also used[46].

Table 2.2 Energy Balance of Pakistan [47]

Energy Balance		**Total**	**Per Capita kWh**
Electricity	Own consumption	92.33 bn kWh	435.08 kWh
	Production	109.70 bn kWh	516.93 kWh
	Import	490.00 m kWh	2.31 kWh
Crude Oil	Production	90000 bbl	0.000 bbl
	Import	168200 bbl	0.001 bbl
	Export	13150 bbl	0.000 bbl
Natural Gas	Own consumption	45.05 bn m3	212.28 m3
	Production	39.05 bn m3	184.01 m3
	Import	6.00 bn m3	28.29 m3

Table 2.3 Carbon footprint [47]

Carbon Footprint	**CO2 Emissions in 2014**	**Per Capita**
Diesel + Gasoline	72.30 mt	0.37tt
Natural Gas	65.04 mt	0.33tt
Coal	12.69 mt	0.07tt
Other Sources	15.96 mt	0.08tt
Total	**166.30 mt**	**0.85tt**

The production capacity provided for electricity has theoretical value, which can only be obtained under ideal conditions. They measure the amount of energy that can be boasted, which will be achieved under the full and complete use of all power plants. In this practice, it is not possible, for example. Solar collectors are lower than the clouds. Also wind and water power plants do not always operate under full load. All of these values are useful only in relation to other energy sources or countries[46].

Table 2.4 Production capacities per energy source [47]

Energy Source	**Total in Pakistan**	**Percentage in Pakistan**	**Per Capita**
Fossil Fuels	146.10 bn kWh	62%	688.45 kWh
Nuclear Power	11.78 bn kWh	5%	55.52 kWh
Waterpower	63.62 bn kWh	26%	299.81 kWh
Renewable Energy	16.50 bn kWh	6%	77.73 kWh
Total Production Capacity	**235.64 bn kWh**	**100%**	**1110.40 kWh**

Power can be provided including wind power, solar, biomes and geothermal power sources. This is the newest resource that will renew yourself in the short future or is available permanently. It is approved by the lodge to regulate rivers or tides. Otherwise, many ponds or reservoirs also produce mixed forms, for example, by curbing air into their cages at night and restoring energy to them during the day asking for electricity to increase. Because they cannot determine the amount of power that is clearly plotted, all energy from hydro power will be exposed separately[46].

In 2015, labor may account for approximately 46.5 percent of the actual use in Pakistan. The following chart shows the percentage of parts from 1990 to 2015:

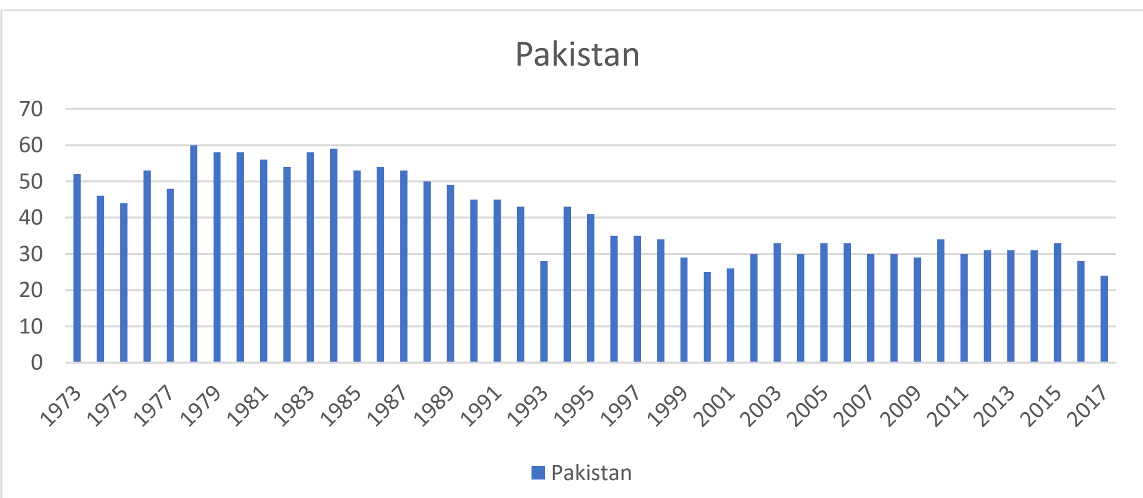

Figure 2.21 Usage of renewable energies

2.2.1. Major Projects

Table 2.5 Hydropower plants operated under WAPDA [48]

Hydro power Plant	Capacity in MW	COD
Terbala	3478.0	1977
Mangla	1000.0	1967
Warsak	243.0	1960
Chashma	184.0	2001
Ghazi Brotha	1450.0	2003
Dargai	20.0	1951
Shadiwal	13.5	1961
Rasul	22.0	1952
Jagran	30.0	2000
Chitral	1.0	1975
Khan khwar	72.0	2012
Gomal Zam Dam	17.0	2013
Nandi pur	14.0	1963
Renala	1.1	1925
Jabban	22.0	1935
Allai khwar	121.0	2013
Duber Khwar Dam	130.0	2013
Kurram Garhi	4.0	1952
Chichoki	13.2	1959
Jinnah Barrage	96.0	2013

Table 2.6 Thermal power plants operated under WAPDA [48]

Thermal Power Plant	Capacity in MW	COD
Gas Turbine Power Station, Faisalabad	244	1975
Gas power station, Multan	195	1960
Steam Power Station, Faisalabad	132	1967
Thermal Power Station, Muzaffargarh	1350	1995
Thermal Power Station, Guddu	1655	1974
Gas Turbine Power Station, Kotri	174	1979
Thermal Power Station, Jamshoro	850	1989
Thermal Power Station, Larkana	150	-
Thermal Power Station, Pasni	17	-
Gas Turbine Power Station, Panjgur	39	-
Thermal Power Station, Quetta	35	1994
Gas Turbine Power Station, Shahdra	59	1969

Table 2.7 Thermal Power plants operated under KESC [48]

Thermal Power Plant	Capacity in MW
Korangi Combined Cycle Power Plant	247
Bin Qasim Thermal Power Station I	1260
Bin Qasim Thermal Power Station II	560
Korangi Gas Turbine Power Station	97.5
SITE Gas Turbine Power Station	97.5
Korangi Combined Cycle Power Plant	247
Bin Qasim Thermal Power Station I	1260

Table 2.8 Thermal power plants operated under IPPs as per energy policy 1994 [39]

IPP	**Capacity MW**	**COD**	**Technology**
Lalpir Ltd.	362	1997	Oil-Fired Steam Turbine
Pak Gen. (Pvt) Ltd.	365	1998	Oil-Fired Steam Turbine
Altern Energy Ltd.	29	2001	Gas fired diesel
Fauji Kabirwala Power Company	157	1999	Combined Cycle + Steam Turbines
Gul Ahmad Energy Ltd.	136	1997	Diesel engine
Habibullah Coastal Power (Pvt)	140	1999	Combined Cycle
Japan Power Generation (Pvt) Ltd.	120	2000	Diesel Engines
Kohinoor Energy Ltd.	131	1997	Diesel Engines
Liberty Power Project	235	2001	Combined Cycle
Rousch (Pakistan) Power Ltd.	450	1999	Combined Cycle
Saba Power Company Ltd.	125	1999	Steam Turbines
Southern Electric Power Company Ltd.	136	1999	Diesel Engines
Tapal Energy Ltd.	126	1997	Diesel Engines
Uch Power Ltd.	586	2000	Combined Cycle
Davis Energen Power Project	10	2013	Combined Cycle

Table 2.9 Thermal power plants operated under IPPs as per energy policy 2002 [39]

IPP	**Capacity in MW**	**COD**	**Technology**
Attock Gen Ltd.	165	2009	Diesel Engines

Atlas Power Ltd.	225	2009	Combined Cycle
Engro Energy Ltd.	227	2010	Combined Cycle
Foundation Power Company Ltd.	185	2011	Combined Cycle
Halmore Power Generation Company Ltd.	225	2011	Combined Cycle
Hub Power Project, Narowal	220	2011	Diesel engine
Liberty Power Tech.	200	2011	Combined Cycle
Nishat Power Ltd.	200	2010	Reciprocating Engines
Nishat Chunian Ltd.	200	2010	Reciprocating Engines
Orient Power Company Ltd.	229	2010	Combined Cycle
Saif Power Ltd.	229	2010	Combined Cycle
Sapphire Electric Company Ltd	225	2010	Combined Cycle
Uch II Power Project	404	2014	Combined Cycle
Kot Addu Power Company Ltd.	1638	1996	Combined Cycle
Attock Gen Ltd.	165	2009	Diesel Engines

Table 2.10 Nuclear power plants operated under PAEC [39]

Nuclear Power Plant	**Capacity (MW)**	**COD**
Karachi I, Sindh	137	1972
Chashma I, Punjab	325	2000
Chashma II, Punjab	325	2011
Chashma III, Punjab	340	2016

Table 2.11 Currently operational wind IPPs [49]

Wind IPP	**Capacity in MW**	**COD**	**Location**
FFC Energy Limited	49.50	2013	Jhimpir
Sapphire Wind Power Company Limited	52.80	2015	Jhimpir
Three Gorges I Pakistan Wind Farm (Pvt.) Limited	49.50	2014	Jhimpir
Zorlu Enerji Pakistan (Pvt.) Limited	56.40	2013	Jhimpir
Foundation Wind Energy I Limited	50.00	2015	Gharo
Foundation Wind Energy II (Pvt.) Limited	50.00	2014	Gharo

Table 2.12 Wind Power Plants at different stages of development with current status [49]

IPP	**Capacity in MW**	**Current Status**	**Location**
Yunus Energy Limited	50	FC achieved, under construction	Jhimpir
Sachal Energy Development Pvt. Ltd.	49.50	FC achieved, under construction	Jhimpir
Metro Power company Ltd.	50	FC achieved, under construction	Jhimpir
Tapal wind energy Pvt. Ltd.	30	FC achieved, under construction	Jhimpir

United energy Pakistan Pvt. Ltd.	99	FC achieved, under construction	Jhimpir
Hydro China Dawood Power Pvt. Ltd.	49.50	FC achieved, under construction	Gharo
Master wind energy Ltd.	49.50	FC achieved, under construction	Jhimpir
Tenega Generasi Ltd.	49.50	FC achieved, under construction	Gharo
Gul Ahmad Wind Power Ltd.	50	FC achieved, under construction	Jhimpir
Jhimpir Wind Power Ltd.	50	FiT awarded, LoS issued	Jhimpir
Hawa Energy Pvt. Ltd.	50	FiT awarded, LoS issued	Jhimpir
Hawa Energy Pvt. Ltd.	50	FS approved, FiT awarded	Jhimpir
Hartford Alternative energy Pvt. Ltd.	50	FS approved, FiT awarded	Jhimpir
Three Gorges III Wind Farm Pakistan Pvt. Ltd.	49.5	FS approved, FiT awarded	Jhimpir
Three Gorges II Wind Farm Pakistan Ltd.	49.5	FS approved, FiT awarded	Jhimpir
Tricon Boston Consulting Corporation Pvt. Ltd, A	50	FS approved	Jhimpir
Tricon Boston Consulting Corporation Pvt. Ltd, B	50	FS approved	Jhimpir
Tricon Boston Consulting Corporation Pvt. Ltd, C	50	FS approved	Jhimpir

Zephyr Power Pvt. Ltd.	50	FS approved	Gharo
Western Energy Pvt. Ltd.	50	FS in process	Jhimpir
China Sunec Energy Pvt. Ltd.	50	FS in process	Nooriabad
Burj Wind Energy Pvt. Ltd.	14	FS in process	Gajju
Trans-Atlantic Energy Pvt. Ltd.	50	FS in process	Jhimpir
Shaheen Foundation PAF	50	FS in process	Jhimpir

Table 2.13 Solar power projects at different phases of development [50]

Name of Company	**Capacity in MW**	**COD**	**Location**
Access Solar Pvt. Ltd.	11.52	2018	Pind Dadan Khan, Punjab
Act Solar Pvt. Ltd.	50.00	2018	Sindh Province
Bukhsh Solar Pvt. Ltd.	10.00	2017	Pind Dadan Khan, Punjab
ET Solar Pvt. Ltd.	25.00	2018	Gharo, Sindh
Jafri & Associates	50.00	2018	Nooriabad, Sindh
Forshine (Pakistan)	50.00	2019	Gharo, Sindh
Safe Solar Power Pvt. Ltd	10.00	2017	Bahawalnager, Punjab
AJ Power Pvt. Ltd.	12.00	2017	Adhi Kot, Punjab
R.E. Solar I Pvt. Ltd.	20.00	2018	Dadu, Sindh
Harappa Solar Pvt. Ltd.	18.00	2017	Harappa, Punjab
Jan Solar Pvt. Ltd.	10.00	2018	Sultanabad, RYK, Punjab
Siddiq sons Energy Karachi	50.00	2018	Chakwal, Punjab
Blue Star Hydel Pvt. Ltd.	1.00	2017	Pind Dadan Khan, Punjab
First Solar Pvt. Ltd.	2.00	2018	Makhayal, Punjab
Access Electric Pvt. Ltd.	10.00	2018	Pind Dadan Khan, Punjab

Janpur Energy Limited	10.00	2018	Mehmood Kot, Punjab
Adamjee Power Generation Pvt. Ltd.	10.00	2018	Norsar, Punjab
ET Solar Pvt. Ltd.	50	2018	Fateh Jhang Road, Punjab
Integrated Power Solution	50	2018	Nooriabad, Sindh
Asia Petroleum Ltd.	30	2018	Punjab
Solar Blue Pvt. Ltd.	50	2018	Nooriabad, Sindh
R.E. Solar II Pvt. Ltd.	20	2018	Dadu, Sindh
Blue Star Electric Pvt. Ltd.	1	2017	Pind Dadan Khan, Punjab
Crystal Energy Pvt. Ltd.	2	2019	Sambrayal, Punjab

Table 2.14 Power potential of micro hydro in Pakistan [42]

Area	**Capacity in MW**	**No. of potential sites**	**Remarks**
Punjab	560	300	Canals
Sindh	120	150	Canal falls
KPK	750	125	Natural falls
Gilgit Baltistan	1300	200	Natural falls
Azad Jamu & Kashmir	280	40	Natural falls

Table 2.15 Micro hydro operational power plants [42]

Thermal Power Plant	**Remarks**	**Capacity in MW**
Reshun HES, KPK	Chitral	4.2
Chichoki, Punjab	Upper Chenab Canal	13.2
Renala, Punjab	Lower Bari Doab Canal	1.1
Shadiwal, Punjab	Upper Jhelum Canal	13.5

Dargai, KPK	Malakand	20
Pehur HES, KPK	Sawbi	18
Rasul, Punjab	Upper Jhelum Canal	13.8
Shishi HES, KPK	Chitral	1.8
Nandipur, Punjab	Upper Chenab canal	13.8

Table 2.16 Sugar mills with functioning bagasse based power plants [51]

Name of Company	**Capacity in MW**	**Location**
RYK Mills Ltd.	30.00	Rahim Yar Khan
JDW Sugar Mills II	26.35	Rahim Yar Khan
JDW Sugar Mills III	26.35	Ghotiki
Chiniot Power Ltd.	62.40	Chiniot

2.3. Policies of Pakistan

2.3.1. General Overview

Table 2.17 Salient features and objectives of energy policies since 1994 [39], [52]

Energy Policy	**Highlighted Features**
1994 [39], [52]	▪ The freedom for investors to propose locations, technologies, and fuels (furnaces, diesel, natural gas, LPG, sun, wind, and heat) for power generation projects. ▪ WAPDA / KESC will act as a power buyer with a US exchange rate of 6.5 / kWh for the first ten years. ▪ Free from sales tax, customs tax, income tax, flood relief fund, import license fees and other additional fees for IPPs.

		▪ Fuel supply contract ▪ Foreign currency risk liability ▪ Power purchase contract ▪ Operating windows for IPPs by building PPIB
1995	[39], [52]	▪ Focus on the hydro power project ▪ Buying contract for a hydro power project ▪ WAPDA / KESC will act as the ruling buyer with a US $ 6.1 / kWh penalty fee for the hydro power project ▪ Excise and duty protection ▪ Safety against various levels of replacement
1998	[39], [52]	▪ Open bid price in rupees ▪ Rates will be mentioned in two parts: energy purchase price and capacity purchase ▪ Tax protection and duties ▪ Security against exchange rate variations ▪ Protection against political risk
2002	[39], [52]	▪ Open rates for rupees ▪ The tariff will be purchased in two parts: the purchase price of energy and the purchase price of cotton ▪ Hydro power projects will be transferred to Build Operate Transfer and the term power projects will be the same in BOOT or Build Own Operate ▪ The truth is that importing non-metal and local equipment is excluded from duty
2006	[39], [52]	▪ Inviting the private sector to invest: Network-connected IPPs, self-use or sales to facilities, self-use or specialized facilities and power plants projects on the Island.

- Except for all other grid-related projects, it does not require LoI, LoS, and IA from AEDB.
- NTDC will be the purchasing power of the renewable energy project.
- Provides clean measuring facilities for electricity manufacturers to sell and buy electricity to and from networks and complete accounts.
- Provides transparent tariff determination.
- AEDB will act as a window of opportunity to implement REP.
- AEDB will measure Meteorological data (wind speed and sun insulation).
- Sales tax exemption or customs tax exemption on renewable energy projects
- Free of income tax.
- Local and foreign financing is allowed.
- The shift from conventional local fuel to expensive to cheap.
- Improve efficiency and reduce channel loss by controlling power theft

2013 [39], [52]

- Fostering power guarantee capacities that can meet the needs of Pakistani workers in the best possible way.
- Realizing the philosophy of preservation and preservation.
- Ensuring commercial and commercial financing for domestic, commercial & industrial use.
- Reduce divorce and pollution in fuel supplies.
- Stimulating the finesse of world class standards in the exercise of power.
- Create sophisticated delivery circuits.
- Reduce deficiencies in the system.
- Subtract fiscal losses from the system.
- Increase ministries involved in the authority sector and improve business management

2015 [39], [52]	▪ To encourage local and foreign investors in the energy field. ▪ To provide adequate power generation capacity at the least cost ▪ Ensures the exploitation of the original source ▪ Ensure win-win situation for all stakeholders

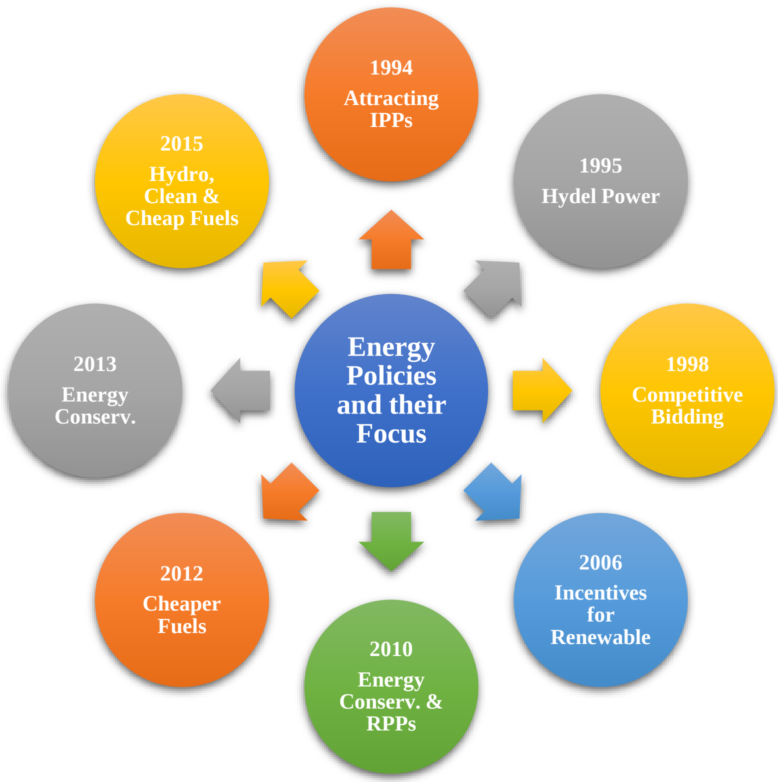

Figure 2.22 Energy Policies and their major Focuses

2.3.2. Regarding Solar

The solar system that received the grid was first published in the country in 2010 and was approved by the Pakistani Industrial Majesty (PEC) to install a 178 kW solar PV project by facilitating clean measurements that provide additional power to the grid [53]. Because of the unique geographic coordinates and variations of the season, Pakistan is a pro for solar power. On average the sun is successful for 8-10 hours / day for more and more than 300 days in increasing [54]. Following a meticulous budget by Pakistan's AEDB it contains 2900 GW of solar potential [55]. The Government of Punjab started a major solar project in the Quaid e Azam Solar Park (QASP) which initially produced 100 MW with a capacity of 1000 MW reached in QASP [42], [56]. PCRET has emitted various small houses, mosques, colleges and highways by installing 300 small solar systems with a capacity of 100 kW. The solar system on the tiled roof has gained popularity in this country and people are busy investing in their homes and making it easy with the tried and tested solar system. Together with various IPPs about the grid, this shows interest in logic, solar power, and is now under different coaching phases.

In 2003 the Punjab government sponsored a project called "Ujala" to distribute a solar system of 30 W [57] to eligible students based on merit in an effort to repay them for the burden on the country. Recently, solar highway lighting systems are being implemented in various major cities in Pakistan. Solar energy can be used either for thermal or electrical purposes. Despite REP 2006, the government needs to announce more incentives to IPPs to increase solar PV usage with the intention of competing for conventional energy sources and to reach solar grid parity to replace expensive conventional energy sources with solar energy. Solar grid parity is also referred to as socket parity is the condition when electricity ($ / kWh) is generated from a solar PV system less than electricity (kWh) available from the grid [58]. Literature states that the achievement of grid parity accelerates the development of renewable energy.

Table 2.18 FiT for Solar power [50]

Project Capacity in MW	**FiT for North (cents/kWh)**	**FiT for South (cents/kWh)**
1-20	11.5327	10.8920
21-50	11.4460	10.8101
51-100	11.3560	10.7251

2.3.3. Regarding Biomass

Pakistan, an agrarian country where 70% of the population lives in the larger villages [51] does not use pipelines or pipelines. Therefore, it can be said that nearly 70% of Pakistan's population depends on the remnants of plants, main forests and electric guards based on small diesel oil to fulfill their reassurance. The rest of the plant is burned in an unproductive way for cooking purposes while straw is used for animal feed. Animal wastes and crop residues are the main sources of biogas [57] which can meet the electrical and gas requirements in villages in Pakistan. The Pakistan Technology Negotiations Council (PCAT) is now exchanged for the Pakistan Technology Renewable Technology Majlis (PCRET) which was produced at biogas refineries in 1976 and has installed 5357 biogas under various ranks throughout the country. Now the industrial-scale biogas lodge also works in the country, some of which are in the Starlet shoes, Ashraf Zia agriculture, Tahir tenusu fields, Al Hamad exports and JK fields that use biogas to search for electric guards.

Currently there were 83 sugar industries working in Pakistan. The raw material from refineries called sugar cane is an ideal electrical source. These sugar refineries have a potential of 3 GW from which 4 sugar industries are supported with a capacity of summarizing as much as 145 MW as contained in Schedule 15. Together with that 18 projects of the combined 570 MW capacitance sugar industry are in LoI staged by AEDB [45].

2.3.4. Regarding Wind

In a renewable energy development race, the wind is blowing in Pakistan. The National Renewable Energy Laboratory (NREL) has assisted the Pakistan Meteorological Department (PMD) in measuring 46 different areas for locating wind corridors in Sindh and Baluchistan. The results obtained were analyzed and analyzed by the AEDB which declared the area 9750 km2 Kati Bandar, Sindh [57] perfect wind corridor. Wind corridors have a 25% capacity factor [59] in Sindh with a potential wind of 60 GW [60], [61] of which 11 GW could be exploited [62]. Wind data provided by the AEDB failed to attract local and foreign investors as investors claimed that wind data was not collected according to international standards. Therefore, to develop wind culture in AEDB countries and the United Nations Development Program (UNDP) under the Global Environment-funded wind energy program (GEF) and to install wind speed poles in potential wind farms in Pakistan. The data collected shows the potential for strong winds in the country. Average monthly velocity data for 2008–2009 collected from three different columns installed at Babur band, Kati-Bandar and Hawks bay [45], [49].

In addition, joint ventures by NREL and USAID reveal a potential of 346 GW [59] in countries where 120 GW is technically advantageous to power the national electricity network [59]. Pakistan's Renewable Energy Technology Council (PCRET) is strengthening remote villages by installing small wind turbines from 0.49 to 9 kW. To capitalize on the potential profitability of the investment, the GoP proposes favorable incentives for local and foreign investors as provided in REP 2006 in Table 1. Feed in Tariff (FiT) is one of the incentives provided to IPPs shown in Table 20 for several years.

Table 2.19 FiT for wind power [50]

Year	**Upfront Tariff for wind (Rs/kWh)**
2012	12.6100
2013	13.1998
2015	10.6048

2.3.5. Regarding Hydropower

Breakthroughs in the national power sector took effect in 1967-76 supported by giant twin plants (Empang Mangla and Terbala) into the system. At that time the power mix was the dominant hydro power which turned into thermal later in the 90s. Besides Pakistani hydro authorities, living things in micro-hydro with summative capacities that can be executed 3100 MW[42]. This micro hydro potential can be found in native valleys and floating canals in all regions of the country as detailed in Table 10. Having extensive pre-experience in hydro projects, micro hydro has been initiated in Punjab and Khyber Pakhtun Khawa (KPK).

2.4. Policies of World

2.4.1. Policies in the Heating and Cooling Sector

Heating is the last major energy consumption, accounting for over 50% of total energy consumption in 2015, with more than 70% of fossil fuels consumed. Renewable energy can play a major role in decarbonization and provide clean heating and cooling options.

Specific policies and steps to guide until now are relatively neglected aspects of energy transition[63].

The slow pace of renovations to existing building stock and the slow recovery in heating and cooling in buildings and industries require long-term strategies to blur the sector. States should set specific goals for innovation in heating and cooling and develop strategies to achieve their goals[63].

Various barriers demand various instruments, often combined. Policy approaches differ in their differences in heat demand, infrastructure and other contextual factors and they can be grouped around support for renewable energy for regional heating and cooling, industrial and hot water heaters, clean cooking, and renewable energy in competition with individual heaters, natural gas. The most frequently used policies are financial and fiscal mandates and incentives[63].

Mandates and obligations, such as those used for solar water heaters in some countries, offer increased security guarantees of use. Building codes can also support the heating and cooling of the updates by adjusting the energy performance conditions. Although only used for new buildings, they provide the opportunity to align energy efficiency with renewable energy needs. The principles of heat efficiency and renewable energy must be in line with the lever synergy and accelerate the transition[63].

Fiscal and financial incentives are often used to reduce the cost of renewable heating capital, and to create playgrounds with fossil fuels. They can be used to support regional energy infrastructure that enables the integration of various renewable heat options. Recently, heat-based incentives are being used, providing long-term support. Fiscal incentives are also sometimes available for renewable cooling solutions, although most policy efforts have improved AC efficiency[63].

Carbon or energy taxes can also tell important prices and reduce foreign conditions, but challenges of form and implementation remain, especially in contexts where power-intensive industries are conquered for strong international relations and can ask for help[63].

More effort at the base rank is needed in most countries. The question of the basis for profit must change between countries, reflecting different circumstances (for example, building stock, demand for industrial profits, and potential resources) and certain obstacles that need to be overcome., however, all countries need to aim for reforms in the sector of addition and cooling and develop strategies to achieve them, coupled with measures for energy efficiency[63].

Table 2.20 Strengths and limitations of policy instruments used to promote the use of renewables to produce heat

Policy Instruments	**Strengths**	**Limitations**
Targets	Provides clear direction for travel; send signals to consumers and industry.	Not memorable alone; Basic steps are required to be implemented.
Financial incentives	Increasing the competitiveness of renewable heat compared to fossil fuels, can help overcome higher capital cost barriers.	The support stage is subject to change, which is often a change of political virtue.
Heat generation-based incentives	Provides long-term support.	May involve high cumulative costs; does not address the issue of a high preliminary cost.
Carbon or energy taxes	Works as an important price signal; dealing overseas; can change over time.	Politics is difficult to implement; Sometimes given to certain industries, making it less memorable.
Renewable portfolio standards	Provides certainty about usage rate.	Generally, less aspiring to profit than to electric.
Mandates	Required; giving greater assurance of increased use.	Only given to foster new, once again have to wait for limited requests.

Building codes	Provides the opportunity to align energy efficiency with renewable heat needs.	Only given to foster new, once gusagi part of the demand for profit; rarely used for buildings available.
Ban on fossil fuel heating options	Required; gives greater assurance of success.	Appropriate alternatives must be provided.
Information	It is important to create awareness of options, costs and benefits.	Most memorable was agreed to be done as part of the advice of personal personnel that was expensive to deliver.
Standards and certification	It's important for the supply chain and increasing consumer confidence.	It is not possible to cause many uses without financial incentives.
Capacity building	It's important for the supply chain.	It is not possible to produce much use.
Demonstration (pilot) projects	It is important to test local suitability.	It is not possible to produce much use.

2.4.2. Policies in the Transport Sector

Transportation is the second largest energy consumption sector, accounting for 29% of total energy consumption in 2015. Transportation is still dependent on fossil fuels, with 96% of the sector's energy consumption coming from petroleum products. In contrast, transportation accounted for 64.7% of world oil consumption in 2015[63].

With the exception of biofuels, there is little practical experience in building renewable energy in transportation. Most policy interventions to date have been related to biofuels, while policies aimed at expanding electricity transportation based on recent updates have begun to emerge. The use of renewable energy in transportation requires simultaneous and integrated change in three key areas: 1) availability of energy and fuel carriers generated from renewable sources; 2) use of vehicles that can use renewable fuel; and 3) development of energy and fuel distribution infrastructure REN21[63].

Policies and planning should aim to address key barriers, such as the inability or high cost of a particular technology, inadequate energy infrastructure, slow-moving considerations and slow adoption among consumers as new technologies and systems are introduced. They also need to increase their understanding among decision-makers in the energy and transportation sectors, to enable integrated planning and policy design[63].

Given the high level of dependence on the transport sector on fossil fuels, the elimination of fossil fuel subsidies is important to commercialize the transportation sector. This is true for shipping and aviation as both sectors now benefit from the benefits and exemptions of fuel taxes[63].

In this context, carbon prices will be a key tool in stimulating the dissolution of the transportation sector, though implementation may be challenging and will require a lot of work to reach global commitments. In addition, low-carbon fuel standards that include reducing greenhouse gas emissions from the lifecycle and sustainability criteria are useful steps to facilitate transportation dissolution[63].

In general, the diversification of the transport sector remains a major task that requires fundamental changes in the nature and structure of transportation demand, improved efficiency and changes in energy mix, all of which require major policy rejection[63].

Table 2.21 Renewable transport policy instruments: Strengths and limitations

Policy Instruments	**Strengths**	**Limitations**
Research and development, demonstration funding. Financial de-risking measures	Must support delivery of early commercial projects for technology with long term market potential but high investment risk.	Financial risk related to potential project failure.
Rollout	Demand for increased use of electric vehicles and alternative fuels.	This is necessary to offset low infrastructure costs while low initial demand.

Vehicle standards	Make sure the fuel is matched to the vehicle.	The financial investment and time required by the original equipment manufacturer.
Low-carbon fuel standards	Neutral Technology; technology assistance can offer de-carbonization relative to cost.	It is not possible to stimulate demand for higher costs, less sophisticated technologies with long term potential.
Vehicle emission standards	Towards a more efficient use of fuel, regardless of type, and switching to more efficient power plants.	Requires transparent and representative performance testing; can increase capital costs; requires contact with the manufacturer of the original vehicle equipment.
Zero-emission vehicle mandates	Required; higher certainty of increased consumption, which is key to stimulating private sector investment.	Requires transparent and representative performance testing; can increase capital costs; requires contact with the manufacturer of the original vehicle equipment.
Obligations and mandates for the share of renewables in fuel	Required; higher guarantee of increased use.	Requires proper government oversight to ensure compliance.
Fuel taxes	Increase the competitiveness of low-carbon renewable options with fossil fuels.	Defining a good life cycle for wheel release is complicated and time-consuming; The decision depends on the assumption and therefore can be debated.
Public procurement	Can serve as a starting point for increasing general usage.	Only considers specific parts of the request and should be accompanied

2.4.3. Policies in the Power Sector

Although the electricity sector accounted for only one-fifth of total energy consumption in 2015, it has received the most attention in terms of renewable energy support policies. The use of renewable energy in the energy sector continues to grow significantly. Renewable generation grew at an average annual rate of 6.4% between 2009 and 2014, surpassing the growth in electricity demand and non-renewable generation. In 2015, renewable energy provided about 23.5% of all electricity generated, largely from water, followed by wind, bioenergy, and photovoltaic (PV) solar. These developments were driven primarily by lower technology costs and support policies[63].

Investments in this sector are largely driven by regulatory policies such as quotas and bonds and pricing instruments, supported by fiscal and financial incentives. Quotas and mandates allow targets to be reduced to manufacturers and consumers of electricity. They are usually backed by tradable renewable energy certificates[63].

In order to ensure the effectiveness of quotas and certificates, a strong framework is needed to monitor and punish non-compliance, the administration pricing policy (rates and premium feeds) need to keep abreast of changing market conditions and adjust normal rates is one of the few steps needed to reflect the decline in technology costs. In this context, auctions are increasingly adopted, given their ability to find real prices. The auction has raised electricity prices from solar PV in 2016 nearly one-fifth of the price in 2010, reflecting developments in the sector. Land prices were almost double in that period[63].

However, the specific success of the auction in achieving policy and development goals depends on its design. This also applies to other instruments and no single policy can function as a selection policy in all contexts. The choice of a policy instrument should depend on the specific country, state of the market, energy, technology, and destination. In many contexts, auctions are used for large scale projects and food and premium rates for small installations[63].

Distributed generation can be supported through net measurement and net billing. However, careful consideration is needed to avoid costly system and to avoid cross subsidies between consumers who consume themselves and those who do not, voluntary and corporate purchasing programs for renewable energy are an increasingly important part of the energy transition, they often come with information-awareness campaigns that highlight the benefits of renewable energy[63].

Table 2.22 Renewable power policy instruments – strengths and limitations

Policy Instruments	Strengths	Limitations
Targets	Provide clear directions and signals to consumers and industry.	It really depends on your political commitment
Quotas and obligations	Help establish mandatory and binding goals by providing responsible entities to achieve them.	It does not work alone it requires basic steps for implementation
Tradable certificates	This can be improved by starting at a low percentage and then increasing over the years.	It takes measures and systems of monitoring and compliance to overcome deficiencies.
Administratively set pricing instruments	Market-based mechanism that provides additional revenue for generators	In most cases, it must be associated with a tradable certificate system and other mechanisms.
Administratively set pricing instruments	Limited risk to developers. Ideal for markets with low levels of renewable energy development and for small scale projects	It requires compliance and enforcement mechanisms for the market to function
Competitively set pricing instruments	Protect the volatility of energy and electricity prices by introducing fixed price supply	The complexity of the level of adjustments and adjustments, especially as the cost structure changes dynamically

	into the mix of electricity supply	
Net metering/billing	Enables the integration of renewable energy markets	Challenges related to market integration as part of increased innovation
Financial incentives	Provides incentives to generate electricity when supply is low	The risk to generators when electricity market prices are low, and the risk of inflation is high risk (without floor and cover).
Voluntary programs	Flexibility in design and potential for real price discovery	It may incur additional costs to the manufacturer, including transactions, balances, estimates and scheduling

2.4.4. Policies for Energy Access

Centralized (standalone and mini-grid) renewable energy solutions will play a key role in achieving universal access to modern energy services by 2030 - the goal of Sustainable Development Goals (SDGs). 7. These solutions also have the potential to contribute to other eye-catching SDGs. livelihood, education, health, water, employment and gender equality. To realize this benefit, special policies are needed to support the use of centralized renewable energy to accelerate energy access[63].

National energy access plans should consider network solutions above and beyond to achieve timely universal access. Targets for electrification using standalone systems and mini grids have been used by many developing countries. In the case of small networks, the necessary regulatory steps relate to the right to produce and sell electricity, to set key network rates and connections, and to fiscal and financial incentives such as subsidies, grants and tax relief. Noteworthy are the quality assurance framework, steps to facilitate access to financing, capacity building and linking energy services with livelihoods[63].

More attention is needed to reduce traditional fuel consumption for heating and cooking. Energy access plans should prioritize the use of clean, fuel-efficient cooking systems for modern fuels. Quality and standards, awareness raising and capacity building are important components of the provision of clean cooking solutions and should be integrated into energy access plans[63]

2.5. General Overview of Developed Countries

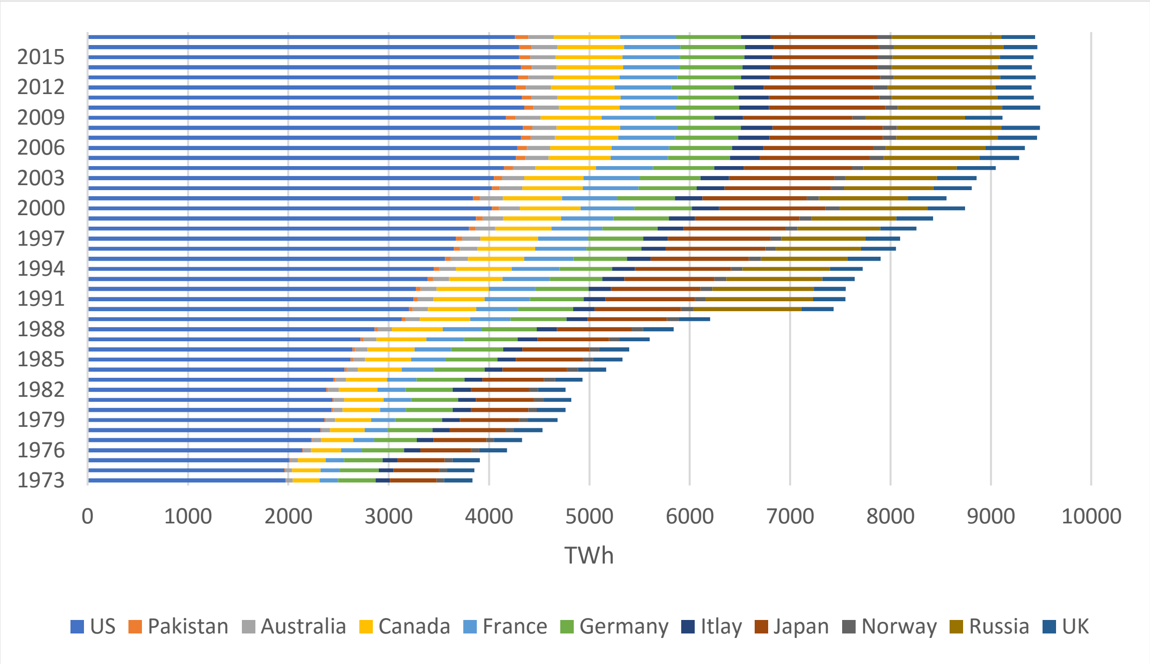

Figure 2.23 Electricity generation (TWh) [20]

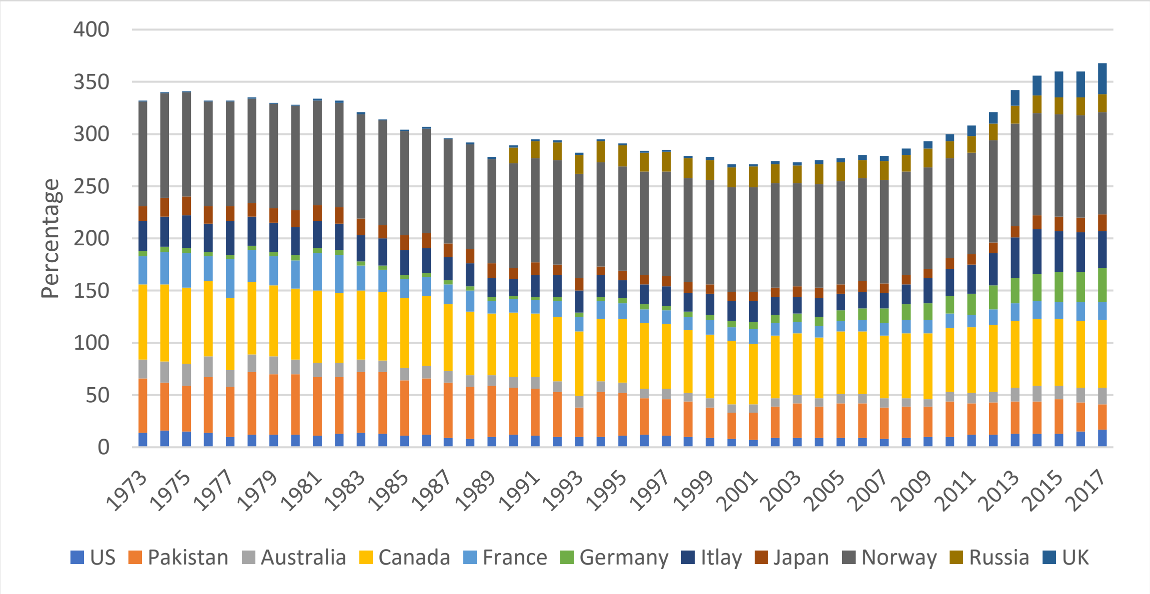

Figure 2.24 Share of renewables in electricity production [34]

2.6. General Overview of Underdeveloped Countries

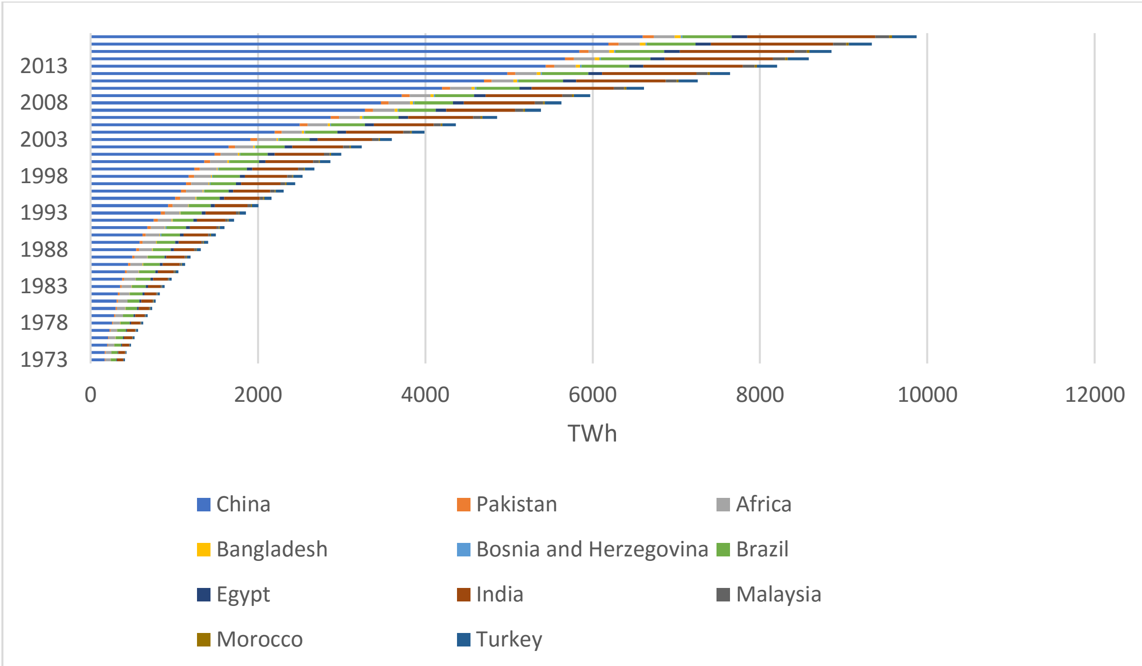

Figure 2.25 Electricity generation (TWh) [20]

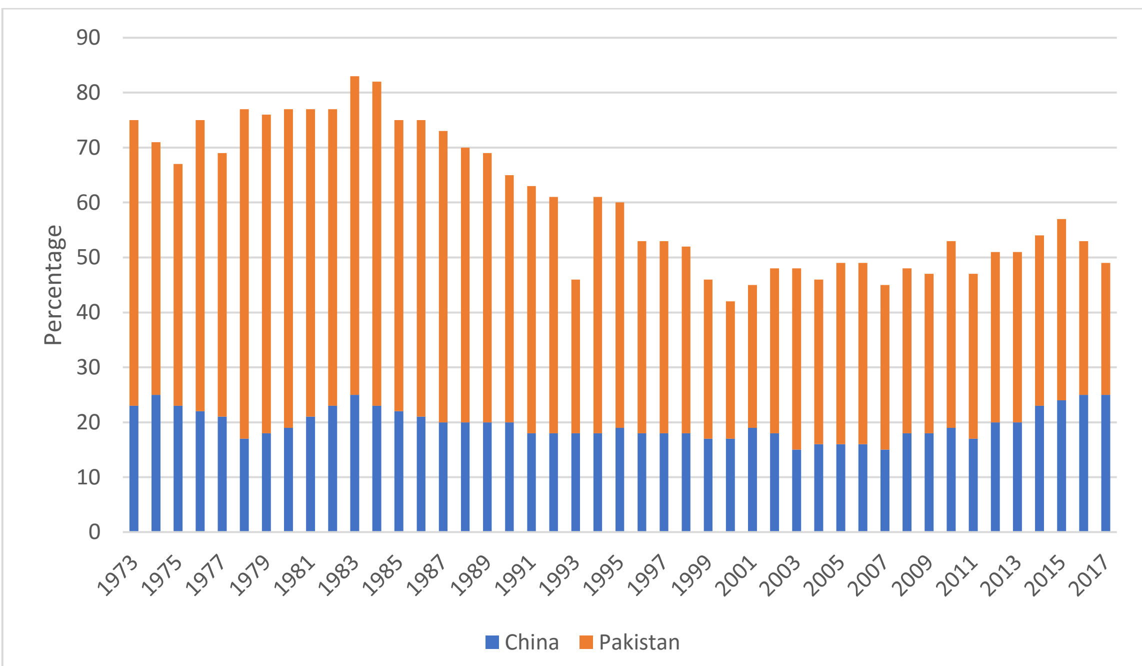

Figure 2.26 Share of renewables in electricity production [34]

Summary

Specialized contemplations increment venture span and installment period as well as diminish costs, outflows, ecological weakness, and the effect of environmental change characterize effectiveness regarding how much helpful energy is produced from high unwavering quality and ease blessing sources. The International Energy Agency appraises that the market for energy effectiveness is blasting because of its comprehension of significant worth, rising energy interest, worldwide development goals, the need to restrict emanations, and environmental change and mechanically progressed ventures. Despite the fact that development is a proportion of how generally utilized innovations are broadly and universally, the vital measures for energy strategy are improving venture unwavering quality characterize dependability as the capacity to fall flat without a calamity under specific conditions for a specific timeframe, however the security of energy frameworks can decrease the impacts of catastrophes. Subsequently, the security of energy frameworks is getting more significant as administrative, innovation, and public wellbeing changes. This is a blend of related orders including dependability, quality, strength, accessibility, and manageability of energy frameworks. Global energy trends as well as energy trend in Pakistan has been discussed briefly along with some major projects being installed. Major policies of Pakistan have been compared with the policies of the world.

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CHAPTER 3

Research Methodology

Energy security is a key element of economic growth and the well-being of the people. However, sustainable green energy transitions, social welfare, and economic growth depend on multidimensional decision-making, policies, and plans. Therefore, multi-criteria decision analysis (MCDA) is a recognized tool that provides in-depth knowledge of decision making. Many research studies [1]–[4] have adopted the MCDA approach using different criteria for energy policy analysis. Therefore, the MCDA method has been used for energy policy analysis in Pakistan and describes the relationship of energy security with environmental security and development. The MCDA contains the selection of criteria and the evaluation of the criteria selected in decision making, the policy applied, and the plan as the main content. Technical, economic, environmental and social criteria were defined in this study (Figure 2). Pakistan's energy policy has been deliberately analyzed in terms of technical (efficiency, maturity, reliability, security, and source identification), social (that is, access to energy as a human right, social acceptance, job opportunities, and cooperation) (domestic gas release) glass, noise, land use, water security, climate change and SDG), and economic aspects (investment costs, O&M costs, fuel costs, net present value, payment period, usage, subsidies, taxes, and compatibility with industry growth). An empirical-based qualitative analysis was conducted to evaluate the considerations of each criterion in energy policy in Pakistan[5].

Figure 3.1 Evaluation criteria for energy policy analysis

3.1. Statistical and Mathematical Model

We will use demand and supply model for comparative analysis.

$$Ed = a - bP \tag{3.1}$$

The above equation is demand equation and liner function of price, where parameters a is for electricity demand and is y intercept in graph and b is slope which is consumption factor and for x-intercept just put value of Ed as 0.

$$0 = a - bP \tag{3.2}$$

$$bP = a \tag{3.3}$$

$$P = \frac{a}{b} \tag{3.4}$$

The above equation is only to find x-intercept for demand curve.

$$Es = -c + dP \tag{3.5}$$

The above equation is supply equation and liner function of price, where parameters c is for electricity supply and is y-intercept in graph and d is slope which is capacity factor and for x-intercept just put value of Es as 0.

$$0 = -c + dP \tag{3.6}$$

$$dP = c \tag{3.7}$$

$$P = \frac{c}{d} \tag{3.8}$$

The above equation is only to find x-intercept for supply curve.

Now for equilibrium condition;

$$Ed = Es \tag{3.9}$$

$$a - bP = -c + dP \tag{3.10}$$

$$a + c = bP + dP \tag{3.11}$$

$$a + c = P(b + d) \tag{3.12}$$

This equation becomes;

$$P' = \frac{a + c}{b + d} \tag{3.13}$$

Where P' is equilibrium price, which shows;

$$P' = f(a, b, c, d) \tag{3.14}$$

Now to find impact on equilibrium price with respect to a we have to take partial derivative of P' with respect to a while keeping other parameters as constant;

$$\frac{\partial P'}{\partial a} = \frac{1}{b + d} \tag{3.15}$$

Now to find impact on equilibrium price with respect to a we have to take partial derivative of P' with respect to b while keeping other parameters as constant;

$$\frac{\partial P'}{\partial b} = \frac{-(a + c)}{(b + d)^2} \tag{3.16}$$

Now to find impact on equilibrium price with respect to a we have to take partial derivative of P' with respect to c while keeping other parameters as constant;

$$\frac{\partial P'}{\partial c} = \frac{1}{b+d} \tag{3.17}$$

Now to find impact on equilibrium price with respect to a we have to take partial derivative of P' with respect to d while keeping other parameters as constant;

$$\frac{\partial P'}{\partial d} = \frac{-(a+c)}{(b+d)^2} \tag{3.18}$$

Now if these partial derivatives $(\frac{\partial P\prime}{\partial a}, \frac{\partial P\prime}{\partial b}, \frac{\partial P\prime}{\partial c}, \frac{\partial P\prime}{\partial d})$ after applying values of parameters have values greater than or equal to 0, then both the parameters a, b, c, d and equilibrium price P' have direct relation which means both will have same direction, if one increases then other also increases and if one decreases then other also decreases.

On the other hand if these partial derivatives $(\frac{\partial P\prime}{\partial a}, \frac{\partial P\prime}{\partial b}, \frac{\partial P\prime}{\partial c}, \frac{\partial P\prime}{\partial d})$ after applying values of parameters have values less than or equal to 0, then both the parameters a, b, c, d and equilibrium price P' have indirect relation which means both will have opposite direction, if one increases then other also decreases and if one decreases then other increases.

Now for equilibrium quantity or in other words in our case for equilibrium energy we will substitute the value of P' in demand equation;

$$E' = a - b\left(\frac{a+c}{b+d}\right) \tag{3.19}$$

$$E' = \frac{a(b+d)}{b+d} - \frac{b(a+c)}{b+d} \tag{3.20}$$

$$E' = \frac{ab + ad - ab - bc}{b+d} \tag{3.21}$$

$$E' = \frac{ad - bc}{b+d} \tag{3.22}$$

Where E' is equilibrium energy, which shows;

$$E' = f(a, b, c, d) \tag{3.23}$$

Now to find impact on equilibrium energy with respect to a we have to take partial derivative of E' with respect to a while keeping other parameters as constant;

$$\frac{\partial E'}{\partial a} = \frac{d}{b + d} \tag{3.24}$$

Now to find impact on equilibrium price with respect to a we have to take partial derivative of E' with respect to b while keeping other parameters as constant;

$$\frac{\partial E'}{\partial b} = \frac{-d(a + c)}{(b + d)^2} \tag{3.25}$$

Now to find impact on equilibrium price with respect to a we have to take partial derivative of E' with respect to c while keeping other parameters as constant;

$$\frac{\partial E'}{\partial c} = \frac{-b}{b + d} \tag{3.26}$$

Now to find impact on equilibrium price with respect to a we have to take partial derivative of E' with respect to d while keeping other parameters as constant;

$$\frac{\partial E'}{\partial d} = \frac{b(a + c)}{(b + d)^2} \tag{3.27}$$

Now if these partial derivatives $(\frac{\partial E\prime}{\partial a}, \frac{\partial E\prime}{\partial b}, \frac{\partial E\prime}{\partial c}, \frac{\partial E\prime}{\partial d})$ after applying values of parameters have values greater than or equal to 0, then both the parameters a, b, c, d and equilibrium price P' have direct relation which means both will have same direction, if one increases then other also increases and if one decreases then other also decreases.

On the other hand if these partial derivatives ($\frac{\partial E\prime}{\partial a}, \frac{\partial E\prime}{\partial b}, \frac{\partial E\prime}{\partial c}, \frac{\partial E\prime}{\partial d}$) after applying values of parameters have values less than or equal to 0, then both the parameters a, b, c, d and equilibrium price P' have indirect relation which means both will have opposite direction, if one increases then other also decreases and if one decreases then other increases.

Summary

Energy security is a critical component of financial development and the prosperity of the individuals. Be that as it may, feasible environmentally friendly power energy advances, social government assistance, and financial development rely upon multidimensional dynamic, strategies, and plans. Thusly, multi-measures choice examination (MCDA) is a perceived device that gives inside and out information on dynamic. Many examinations contemplate have embraced the MCDA approach utilizing various measures for energy strategy investigation. Thusly, the MCDA technique has been utilized for energy strategy investigation in Pakistan and depicts the relationship of energy security with natural security and improvement. The MCDA contains the choice of standards and the assessment of the measures chose in dynamic, the strategy applied, and the arrangement as the fundamental substance. Specialized, financial, ecological and social measures were characterized in this examination. Pakistan's energy strategy has been intentionally dissected regarding specialized (productivity, development, dependability, security, and source recognizable proof), social (that is, admittance to energy as a basic freedom, social acknowledgment, openings for work, and participation) (homegrown gas discharge) glass, commotion, land use, water security, environmental change and SDG), and financial viewpoints (speculation costs, O&M costs, fuel costs, net present worth, installment period, utilization, sponsorships, expenses, and similarity with industry development). An observational based subjective investigation was led to assess the contemplations of every rule in energy strategy in Pakistan. In this section we have used mathematical model to calculate direct and indirect relations.

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CHAPTER 4

Results and Discussion

4.1. SWOT Analysis of Policies of Pakistan

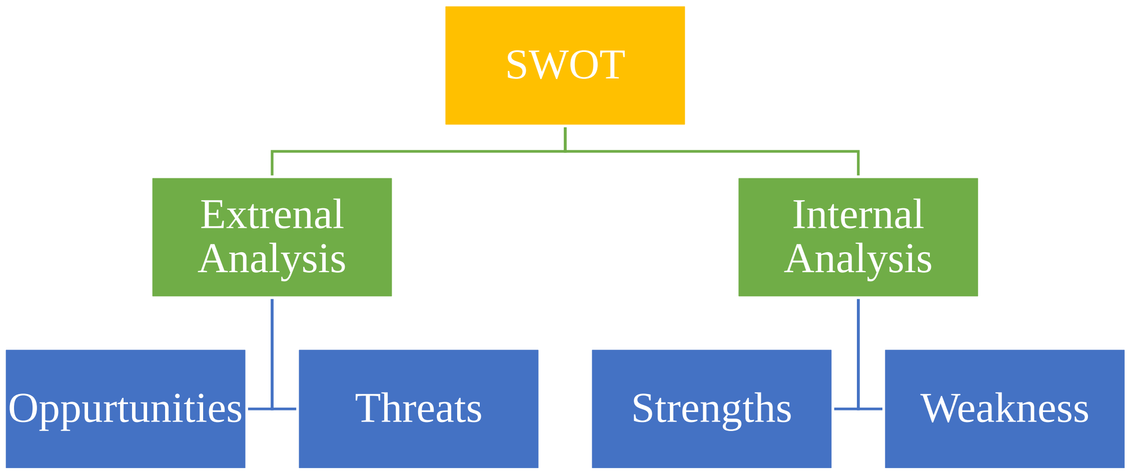

Figure 4.1 Components of SWOT

4.1.1. Strength

4.1.1.1. Pakistan's Geography

Pakistan is in Central Asia. It borders China, India, Iran, Afghanistan, and the Arabian Sea in the Northwest, East, Southwest, West and South. The geographical location of Pakistan is a powerful force that draws other countries to seek their energy, economy and political interests. Pakistan connects Asia and the Middle East. Pakistan facilitates Afghanistan, Central Asian countries and other neighboring countries by giving them easy access to transportation and access to the Arabian Sea for gas and oil trade[1]. Gwadar port is also a strength for Pakistan as it has land access to Iran. Iran wants to build an oil refinery in Gwadar to win more shares in the global oil market. Gwadar is located at the mouth of the Persian Gulf, the third busiest route accounting for 43% of 35% Chinese trade from the international sea [2]. As stated in the policy Pakistan is close to the Middle

East which is the world's leading energy export area and has a coastline of 1000 km. So this is a great strength for Pakistan to get more energy [3].

4.1.1.2. Conventional and non-conventional resources

Electricity consumption in Pakistan increased by days at the rate of 7 from 25 years ago but the installation capacity has not been increased by the energy sector due to lack of investment. Energy demand increased from 10459MW to 18827MW from 2001 to 2013, while energy supply increased just 2% over the same period to 13577MW. The demand gap was 5000 MW in 2013 resulting in 12 to 16 hours a day of discharge [4].

In 2013 the main power supply was 64.5 MTOE. Pakistan's dependence on thermal electricity is 87%, electricity is 11% and nuclear power is 1.7%. The main sources are Gas 31.1 MTOE, Oil 20.96 MTOE, Coal 3.8 MTOE, LPG 0.3 MTOE, Hydroelectric 7.1 MTOE, Electric 1 MTOE nuclear and 0.08 MTOE import power with stocks. The contribution percentages for power plants are 48.2%, 32.5%, 11%, 6%, 1.7%, 0.5% and 0.1% by gas, oil, water, coal, nuclear, liquid gas (LPG) and energy imports. Pakistan has renewable energy potential as well as non-renewable energy source. In the current generation scenario, less than 1% of energy is generated from these sources whereas 2900000 MW of solar power, 34600 MW of wind, 3000 MW of biogas, 2000 MW of small hydro power, and 1000 MW of waste material [5]. Pakistan can produce electricity from coal, gas, electricity and wind as stated in the power policy and they have great potential to produce electricity. It is Pakistan's policy to have natural coal reserves, crude oil, 60 GW, 1 GW sealing potential which has proven wind power in coastal areas and Asia's third largest gas shale reserve. Low-cost energy is generated by shifting the fuel mixture to a lower fuel. Low cost fuel mixes will provide low cost electricity to investors [3], [6].

4.1.1.3. Impending customers and stakeholders

Pakistan's other strength is its investors to generate electricity and customers to buy this energy which ultimately benefits the government. Like Pakistan;

- High demand and supply gaps make the electricity sector attractive to investors
- Big markets for potential customers

- Joint stakeholder council to seek consensus of all stakeholders

The government has several new business models that allow power companies to sell their electricity to the private sector, DISCO and NTDC. If this model is successfully implemented due to this model, the electricity price will decrease. NEPRA and world-class regulations encourage investors to generate electricity and control the Competitive Purchase Process and Rates that will regulate fuel and electricity costs [3], [6].

4.1.2. Weakness

4.1.2.1. Huge demand and supply gap

The main focus of the power policy is the supply demand gap. Based on the 4,500 - 5,500 MW energy demand gap in 2013. The government should eliminate this gap for the good of the country. Important steps taken by the government to provide uninterrupted and efficient energy supply to the community to improve the delivery system and reduce the priority of debt circles. Governments need to prioritize water production because hydrogenation costs are very economical and so many resources are available [7]. Power quality issues are characterized by voltage, current or frequency deviations that cause damage to sensitive equipment. The integration of PV connectors and power plants connected to the inverter, and the extreme increase of non-linear loads have caused harmonic problems in the power system. Non-linear loads and switching devices are suppressed by sinusoidal sources or linear loads and switching devices by sinusoidal sources, producing harmonics in the distribution system[8].

4.1.2.2. High per unit cost generation

Most electricity demand is triggered by expensive thermal fuel sources because electricity prices are so high. The largest sources of power plants are Waste fuel, High-speed diesel, and Mixed. Pakistanis cannot afford electricity. The solution to this weakness is that the government should produce cheap electricity from hydro, sun, wind and more[3].

4.1.2.3. Under develop infrastructure

In Pakistan's economic development, the electricity sector plays an important role. But due to inefficient systems, high losses, poor governance and inadequate infrastructure, the electricity sector is in development [9]. Pakistan has state-of-the-art infrastructure in manufacturing, shipping and distribution. To achieve the medium- and long-term policy goals, governments need to develop infrastructure and incentivize investors. Considering that Pakistan has huge coal and potential for hydroelectric power plants, the government will provide energy corridors and cities and attract investors for its installation. "Leading customer managers or communications managers" provided by the government in the Ministry of Water and Energy will serve as 'window operations' and review and balance investors to ensure timely project completion[3].

4.1.2.4. No attention on the renewable energy resources

The government does not pay attention to renewable sources of energy that receive hydro and wind. The total renewable energy source is a capacity of 167.7 GW, prompting the government to generate electricity from these sources as it has more than enough power for power plants to eliminate the country's demand gap. Only after generating power is some capacity, which is insufficient compared to the potential of all renewable energy sources[3].

4.1.2.5. Unsatisfactory human and institutional capacities

The main problems of the energy sector due to the large supply demand are as follows;

- Poor accountability structure
- Lack of investment
- Corruption
- Technology transfer
- Inconsistent government policy
- The legal and military state of the country
- Lack of mining capabilities
- Lack of data in many related sectors
- There is no R&D sector in the country

To eradicate the weaknesses of the government is to establish some affective basis that must be adhered to by governments, people and all institutions [3].

4.1.2.6. T & D losses

23-25% of shipping and distribution losses are stated in the policy. T&D losses reduce system efficiency. These losses need to be taken to improve the efficiency of the system and improve the Q&A system of the Government of Pakistan, like other developed countries for example. The US and China must adopt new technologies to reduce these losses. These new technologies include isolated gas substitutes, HVDCs and advanced measurements that may be involved in national development [10]. Because the loss of T&D revenue does not need to be increased. If the government is at a disadvantage in revenue collection, then it should increase and this investment will leverage the higher valuation system, create a new generation of factories and develop a delivery infrastructure[3].

4.1.2.7. No attention on coal reserves

The electricity generates in Pakistan by coal depends upon the imported coal which is a large weakness and failure of government. Pakistan produces only 0.79% of electricity from coal but Pakistan stands at 7th number in ranking of coal according to the research, so Pakistan can generate a high amount of electricity from coal. Coal plays a vital role to produce electricity because the energy demand is increasing continuously. The generation of electricity from coal is improved from 0.79% to 6.5% - 7.6% (2003 to 2011) because Pakistan has a potential of 100000MW of capacity of electricity from coal [11].

4.1.2.8. Problems facing by power producers

One of the reasons for the huge electricity supply gap in Pakistan is that the government is not attracting investors by subsidizing or reducing the rate of return. The problems faced by electricity manufacturers are as follows;

- Internal rate of return of 14% for electrical manufacturers.
- Power purchase agreements between governments and manufacturers to ensure consistent producer revenue.

- Price increases due to expiration of subsidies.

To reduce the burden of the spill, the government should simplify the power producers in one of the ways above[3].

4.1.3. Opportunities

4.1.3.1. Availability of saline land

As stated in the policy that 6.3 million hectares of land is not suitable for commercial crops but can prove agricultural for bio fuels. Oil and solar prices have risen because of their scarcity and electricity production. The use of biofuels for energy production is money saving, attractiveness to investors, reduction of environmental emissions and similar properties to fossil fuels. For the above reasons, biofuels are the best source of electricity [12]. Pakistan has 22.2 million ha of agricultural land. The land produces one million tons of biomass (cottonwood, wheat straw, corn stalks, cane and rice waste, rice husk and rice, etc.) a year. Of these residues, Pakistan produces 81 million tons per year which can generate 45.870 million kWh of electricity annually [13]. According to the Pakistan Energy Safety Action Plan (2005-2030) energy production from biomass will feed 4000 MW of electricity to the national network and save USD 200 to 400 million [14].

4.1.3.2. Availability of LPG

In energy mix, LPG contribution is less than 1% while producing 1000 tons a day. LPG is only used as a conventional fuel for non-fuel cooking, coal, dirt or petroleum for cooking purposes where a gas connection is not available. This is a great opportunity for Pakistan to generate electricity from LPG as it has great potential[3].

4.1.3.3. Declining price trend in PV panels

This is a great opportunity for the government, investors and the people of Pakistan to extract electricity from the solar system as there is no fuel cost to generate such costs. The cost of solar modules decreased to 74% in 2009. Installation costs dropped from 2010 to 2014 depending on the area of 30% to 64% for utility scale systems. The unit costs only $ 0.09 from the power supply from this power plant. The cost of solar photovoltaic modules is very low and has great potential for solar power to reduce the cost of financing the power plant [3].

4.1.3.4. Implantation of smart grid

Another opportunity for Pakistan is the implementation of a smart grid for the good of the country. Due to complications in grid management and high energy demand, existing grids are not suitable for plant and distribution systems. Therefore, highly efficient, self-reliant, and reliable grid stations are needed for such development. To overcome this new technology energy crisis is needed as it has many opportunities [15].

4.1.3.5. Huge market for investors

Pakistan is in short supply and has a huge market that is attracting investors and heading towards open market. Pakistan has several strengths and opportunities to generate electricity from various sources such as renewable energy sources, coal and LPG which may be attractive sources for investors[3].

4.1.3.6. Energy mix (Use of coal, hydropower and renewable energy resources)

Pakistan is very rich in coal in Tharparkar with 175 to 185 trillion tons which can produce 100 million barrels for 500 years and 50000 MW of electricity for decades. These sources can generate cheap electricity and provide a boost to the country's economic growth[16]. Pakistan also has 100GW of potential water, 2900 GW of solar power, 120 GW of wind and 5.7 GW of biomass. Water power plants are a very cheap source of electricity and can also be used for agriculture [17]. Electricity from the sources mentioned above may reduce its dependence on fossil fuels. A balanced energy mix source is used for future energy needs [3].

4.1.4. Threats

4.1.4.1. Power theft and recovery of bills

Loss due to electricity theft exceeds Rs. 150 billion a year. It has huge financial losses to the government and has a devastating impact on investors. Theft of electricity and not paying the bills is a major crime in every country especially in Pakistan. Steps must be taken by;

- Government limit steps to stop electricity theft
- DISCO is able to recover energy bills.

The overall solution to this problem or threat is to take some technical steps.

Theft of electricity, physical damage to energy meters, and inefficiency in billing have resulted in more than $ 89 billion in annual financial losses worldwide. These losses are offset by the implementation of smart meters. These meters are designed to prevent electricity theft, automatically monitor and manage energy[18].

4.1.4.2. Circular debt

Pakistan has Rs. 350 billion circular debt. Inefficient systems, power outages, electricity theft, unpaid bills and rising energy costs will increase national debt. By controlling all losses and mistakes, any government can control its circular debt[3].

4.1.4.3. Security issue

The two threats are as follows;

- Water security issues because we are an agrarian society
- Energy security as the electricity sector produces imported fuel

Our agricultural sector uses water for free, annually using 90.9% of the country's water. Because our country is an agrarian country, according to future UN reports, water in our country is not enough for us [19]. We depend on imported fuel to produce electricity, so import fuel is a key issue in energy security. Pakistan's economy is bad because it is difficult for Pakistan to buy imported fuel for large-scale power plants. Generation dependence on imported fossil fuels reflects the country's energy security. This fuel also pollutes the country's environment. According to the Energy Safety Action Plan (2005-2030), "the target of 162,590 MW of power plants by 2030 is projected. This comprehensive security action plan is expected to meet Pakistan's energy needs and enhance national security" [20].

4.1.4.4. Environmental restrictions on use of coal

At present Pakistan is very dependent on fossil fuels which can pose serious threats to the environment. Pakistan is rich in coal reserves. If we rely on coal for electricity, then we face serious threats to the environment. There is high sulfur content in natural coal reserves and there are also restrictions on the use of coal. The best option is to generate electricity from renewable energy sources. Despite the focus of all power generation policies on the production of electricity from natural renewable energy that can control environmental emissions [20].

4.1.4.5. Political instability and long bureaucratic chain

It is also a major threat to Pakistan's energy sector that Pakistan is unstable. Pakistan cannot be politically stable for various reasons. This may be social growth, economic growth and unstable democratic systems. Another threat is Pakistan's long bureaucratic chain for approval of any system in the country. The long bureaucratic chain caused unnecessary delays in starting the project[3].

4.1.4.6. Unnecessary subsidies

Our country's key requirements for the electricity sector are managing our existing systems, controlling our losses, and improving our distribution and distribution systems. If not, another option is to subsidize the department to resolve the issue. Governments subsidize without identifying customer blocks that could lead to increased national debt[3].

4.2. PESTEL Analysis

4.2.1. Political Aspect

Strong political support and long standing at national, regional, or local levels is a consistent component of ET penetration. This support includes key elements of the ET implementation, such as building a regulatory framework and pricing support mechanisms, but also obtaining funding for national programs[21].

All these policies form the basis of the overall national energy plan for ET implementation. One of the most important steps to take in the national plan is the use of official targets for renewable energy levels. When governments set targets, these are important political messages that drive the use of ET. Achieving the next goal will increase the share of renewable energy markets, and as a result, the cost will decrease with increasing production and infrastructure base[21].

The country's energy policy aims to promote diversification and security of supply, to reduce fuel imports and reduce GRK emissions. RE can make an important contribution to this goal. That's why some countries start developing ET support programs more than others, usually for country-specific reasons. For example, energy security is a high priority in countries with few natural sources of fossil fuels and must depend on imports [22].

The socio-economic benefits of the new ET project became an integral part of the political decision to implement new strategies related to ET and sustainable development. This includes not only the role that ET plays in environmental protection, but also its contribution to economic development, employment, and private investment, particularly in rural or inland areas[21].

Another factor contributing to the increasing support for ET is the political attitude towards nuclear power, especially if there is a national desire to use less or less. For example, the creation of strong anti-nuclear and environmental movements in the 70s and 80s and the first German political party in Europe was the catalyst for RE prosperity in Germany [23].

Without the creation of appropriate legal frameworks and regulations, RES would be condemned to remain a small specialty market. Therefore, a key prerequisite for ET development is strong political support through a streamlined bureaucratic application procedure. For example, a clear and simple rule regarding the licenses needed to build and operate an ET system is important. All rules should be as easy as possible. Ideally, a comprehensive RES law should contain all the essential provisions[21].

Table 4.1 provides some examples of how political support can play an important role in RE integration and development.

To conclude, political support includes all other types of support such as financial, legal, and fiscal support. In fact, governments are considered key actors in setting legal frameworks, national targets, and pricing policies and making strategic decisions to support the development of RE.

Table 4.1 International experience on political support for RE development.

Country / Region	**Description and Examples**
Europ e	▪ Target country: Through whitepapers (targeted leads, state funded programs), country plans, and more ▪ In Austria and Denmark, for example, strong political support was mainly aimed at ensuring energy security and to reduce their imports on fossil fuels and coal consumption [24] ▪ In Germany, political support is formed at the regional level through : government financial support (energy policy, targets and support mec hanisms in each region), and grants for research support [25]
New Zealan d	▪ Targets for RET intake They can be long-term (in some years) and short-term (generally for each) and they vary nationally depending on their need and eligibility. ▪ Aggressive long-term goals to generate 90% of electricity from renewable sources by 2025 [26]

4.2.2. Economical Aspect

Economic reflection is an important component of energy policy and the success of energy acquisition into the system. Investment costs include development costs, factory costs, foundations, integration systems, shipping, interface grids, and collection systems. The Government of Pakistan has considered all aspects of investment costs including development, net mapping, shared costs, and the benefits of energy policy. The NPP, PGP 2015, and the DOE Policy are covered by their own build-operations-transfer, interconnection, clean-up rules, bidders, and security package requirements[27].

Operating and maintenance costs can be fixed or changed. NPP 2013 does not address issues related to operations and maintenance. The PGP 2015 and ARE policies have covered operations and maintenance as components of energy purchase prices (EPPs) and capacity purchase prices (CPPs) in tariffs. EPPs include operating costs and maintenance costs, fuel costs, or water use costs. The CPP comprises equity returns, debt service, operating costs, insurance, and operating and maintenance costs. Rates will be adjusted by NEPRA every three months during the project's operating period. The government is committed to introducing security packages in the form of special energy purchase agreements between the Free Energy Manufacturers (ARE-IPP) and the AEDB. POLICE has used energy services, fixed rates, meal rates, fixed rates with reference to the US dollar and premiums to ensure rapid growth. Furthermore, PLTN considers fuel costs. It emphasizes dependence on gas or liquefied natural gas (LNG) by reducing dependence on coal and oil. PGP 2015 should at least focus on waterpower plants. However, the government is currently seeking to attract foreign investment in the hydroelectric power sector. This will reduce emissions and combat the impact of climate change[27].

However, clear investment criteria are at the heart of successful green energy sources.

Net present value is the overall value of cash flows based on time series. It provides useful life and decision-making tools in energy project policy and budget estimation. Pakistan's energy policy has partly accounted for the present net worth and annual cost equivalent to forward rates. The principal interest rates include interest rates, fees, returns, debt services, penalties, and interest rates under the Tariff Regulations and Procedures, 1998 and Section 7 (3) of the NEPRA Act every quarter[27].

The time and return on energy payments represent the amount of time it takes a project to return an investment in a project. The new PLTN is considered an eligible asset and a financial collector during the payment period. This policy has shown a commitment to increase billing (85-95%) in 2017 and set maximum credit limits for creditors (Oil 30 - 45 days / 45-60 days oil). However, the government of Pakistan could not reach this commitment in 2017. It is a policy that recognizes the high rate of return in the order of priority and surplus available to generate conventional power over the life span of renewable energy projects. However, there are significant draft disputes between provinces and federations that require negotiation[27].

It is the government's responsibility to provide affordable, clean and accessible energy to all people under the Global SDGs [28]. As such, the government has reflected on Pakistan's energy efficiency capabilities. NPP 2013 identified high energy costs (12-18 PKR per unit) and is expected to decrease to 10 PKR per unit in 2017. According to the 2015 National Industry Report, approximately 9.84 PKR per unit was recorded in 2015 [29]. Governments can reduce costs by relying on cheap fuel (gas and LNG), introducing subsidies and incentives. The National Power Policy 2013 and PGP 2015 introduce subsidies, incentives. There is a 5% import duty to import technology to encourage private partnerships[30].

Governments have traditionally introduced taxation laws to manipulate the economy [31]. NPP 2013 and PGP 2015 have empowered NEPRA and its territories to approve taxes. The ARE policy has introduced tax deductions on ARE technology to drive green energy.

Energy policy has largely considered economic criteria except for a few gaps. There are net present value in NPP and PGP, less regard for service life and cost.

There is a need to reduce the cost of power generation in all policies as around 10 PKR per unit is still not available to most people and higher than many countries. The policy has empowered NEPRA and its territories to regulate taxes. Taxation and collection are the most controversial issue in Pakistan's energy sector. The province has the authority to levy taxes after the 18th amendment to the national constitution and the National Finance Commission Award. Consumers pay taxes at different rates in different regions. In addition, consumers pay an additional 2.5% tax due to high distribution and shipping losses [29]. Therefore, there is a need to consult with state entities to bridge the gap and provide affordable, accessible, and clean energy [27].

4.2.3. Social Aspect

Integration of basic social aspects and energy planning enhances tar-get effectiveness. According to social contract theory, access to resources is a fundamental component of human rights and achievement in economic development [32]. Therefore, access to energy as a human right should be considered a social criterion in energy policy to increase social acceptance. NPP 2013 and PGP 2015 do not provide access to energy for all as human rights. However, POLICY partially has been conceptualized in terms of universal access to modern technology in all regions of the country[27].

According to [33], social acceptance reflects the representation and response of society to various energy systems and projects to ensure environmental justice, sustainability, and public satisfaction during use. NPP 2013 has taken part in social acceptance in terms of capabilities. PGP 2015 includes social acceptance and benefits in social welfare assessment as part of environmental impact assessment, corporate social responsibility, and Community Wellness Development. The ARE policy has applied social justice, social impact, social development, social assessment and benefits[27].

Different phases of the energy system during its lifecycle, from construction, operation, and demolition to creating employment opportunities for society. NPP does not reflect job creation and employment. PGP 2015 demonstrates excellence in semi-skilled workforce based on performance. It focuses on training that is in line with local staff priorities. The ARE policy has encouraged offshore employment in ARE technology, job creation and enhancement of local technical skills[27].

Social cooperation is a major milestone in the transition of green power, the safety of the natural environment, the ability, and economic development that is empowered. Fundamentals of Power in Pakistan has a gap in social criteria, which requires a large increase. Specific labor bases on cooperation between participants and regions, but ownership rights still cause disputes between provinces and alliances. Despite the territorial and conflicting alliance, carelessness is considered in local communities discussing small power projects. The community emphasizes decentralizing these projects and providing them with appropriate energy. At the same time, the kingdom chose a high and low economic progress from a small power-centered project. Therefore, the decentralization project will reduce costs, increase social cooperation and resolve ownership disputes. In addition, another actor is the most unfit in Pakistan's labor base. The process of dissolving a weak development foundation with renewal and development

(R&D), academic, and layman's complaints. He may not triumph, support, and preserve the natural environment that prevails[27].

Basic Power in Pakistan does not have a primary power and safety ratio. The basics do not support harmony with industrial growth, and efforts to resolve customs and trade ties in the region in an economic perspective. In a social context, the basis for looking highly attention to ownership rights, the valuation of all shareholders and consideration of employment opportunities. The environmental aspects are completely ignored in the power base. The criteria needed to strengthen the power generation include the process of dismissing the base of energy with R&D, academic complaints, strategic surrounding natural assessment (SEA), social, social context, carbon development, advocacy and lay participation that has been provided in the field of power during Pakistan. Labor basics in Pakistan have sufficient effort to guarantee SDGs and guarantee changes in safety. They do not have a development system with the community and the natural surroundings, eventually involving natural forests and development tray in the current global development paradigm. Important gaps in the foundation of defense against the natural environment and development, which prevented this increase. Therefore, mediation that supports aspects of the natural surroundings, social aspects and SDGs in the workforce base is compulsory for development that is in accordance with the natural surroundings and the strengthening of a capable green power[27].

4.2.4. Technical Aspect

Technical aspects consider efficiency, maturity, reliability, security, and resource identification. NPP 2013 has discussed efficiency, transparency, and accountability. These parameters include payment, shipping, tariff efficiency, efficiency-based fuel allocation, retirement from high-cost electricity contracts, and delivery system optimization. This policy aims to reduce shipping and distribution losses from 23-26% to 16% in 2017. There was no significant decrease in transmission and distribution of losses. According to the National Electricity Regulatory Authority (NEPRA), there has been a slight increase in mission and distribution shifts across distribution companies [29]. The ARE policy focuses on efficiency with the achievement of systematic, sustainable, and growing ADA technology nationally. Assistance in building institutional, technical, and operational capacity is committed to reducing costs and improving policy efficiency. However, it appears that the government is less concerned with the development and use of ARE technology domestically. Meanwhile, different types of ARE technologies with variable efficiency without government certification are available in local markets which can reduce green energy efficiency and acceptance[27].

Maturity begins in all policies with the importation and transfer of standard equipment, approval by the relevant Environmental Protection Agency, the Alternative Energy Development Authority (AEDB), and the Energy and Private Infrastructure Authority, while reliably measuring the system or device's ability to do as intended. Reliable equipment and systems reduce emissions and ensure efficient use of resources, protecting the environment. Pakistan's energy policy has shown its ability to improve environmental security[27].

Half the technical gap has discussed labor that demands social, economic, and natural harmony. NPP 2013 and PGP 2015 do not reveal the potential of workers and harmony with industry growth and labor demand. In addition, this basis reflects the capacity for simple output, but it does not reflect on plant trustworthiness, efficient ease, and efficiency. 2015 nuclear power plant is not intermediate. He tried to exploit indigenous sources from native source deposits. Basic Basics is alternative technology through import and transfer of technology. The ADA basis uses the productive ADA technology (green power) for revenue management activities but does not properly address their optimization. NPP, PGP, and Basic AIR Pakistan do not consider the safety of the labor system, which is a potential threat to workers, lay people, and the natural environment. The power distribution system in Pakistan controls surrogate currents but alternative power or green power sources (wind and solar) maintain a continuous flow, which is a true technical obstacle, increasing concentration. Inadequate technical attitude will produce a low cost, low payback, not efficient, and energy that is not intimate environment. The effectiveness of the energy will be brought to the surrounding natural environment including enhancements, high costs, climate change, and internal pollution, which saves safety and environmental development[27].

4.2.5. Environmental Aspect

The country's energy policy views environmental protection as a mandatory dimension. The widespread use of fossil fuels continues to increase the amount of atmospheric greenhouse gases that are metabolized at global temperatures and climates. However, the ARE policy covers greenhouse gas emissions, the Kyoto Protocol, Clean Development Mechanism (CDM), and carbon credit. But the NPP and the PGP do not leak emissions from energy-producing systems and threaten environmental safety. In addition, the contribution of thermal power plants to Pakistan's major energy combinations has the potential to increase greenhouse gas emissions and environmental degradation[27].

Noise is a consistent issue of both non-renewable (nighttime noise of the term) and renewable power plants (wind and hydro). It has invested in human health and the diversity of flora and fauna. However, energy policy in Pakistan does not address sound pollution, which is related to power plants like many other environmental criteria. Meanwhile, biodiversity is also influenced by land use. Energy systems require land, which directly affects the environment and landscape, historic sites, flora and fauna. Pakistan's energy policy is at the heart of land liberation, but does not specify the criteria, type of land use, and its impact on the landscape[27].

Energy security is combined with water security and climate change. Tensions in energy supply and water security are increasing as a result of rising demand and population. Energy supply, economic growth, reduction of greenhouse gas emissions, and environmental protection along with climate change have posed great challenges for the growing economy. There is a need for integration of energy policy with water security and climate change. This is important for energy forecasting, water constraint planning, and climate change mitigation. Pakistan's energy policy does not consider water security or climate change except the ARE policy. It has discussed climate change in terms of the Kyoto and CDM protocols. Lack of integration of energy policy with water security and climate change not only threatens environmental mental health but also impedes development[27].

The global community has received SDGs since 2015. SDG is very critical to ensure the surrounding natural environment, development, energy and air safety. The Kingdom of

Pakistan has approved and endorsed the SDGs, supported them to Pakistan's development standards, and demonstrated a commitment to United Nations towards its implementation. The basics of power in Pakistan only consider capabilities in terms of cost of mastering, inefficient technological prohibition, and excise tax incentives without accessibility. The 2015 NPP addresses sustainability in terms of low costs, fairness and play, and stringing in demand, which embraces economic factors only. The social environment and the triple underline social pillar are not thought of. The labor basics in Pakistan have the least coherence with SDGs required by their formulation and implantation before the SDG summit session by the UN statistical commission in September 2015. At the same time, the South Asian Cooperative Environment Program (SACEP) was related to the need diiktafaf serantau forums for preserving the natural surroundings. SACEP provides guidance on activating change, reducing greenhouse gas emissions and cooperation. However, this designation has been ignored in terms of energy. Coherent shortcomings with the driving force of the construction of trays, green power boosters, and the protection of the natural surroundings[27].

Table 4.2 International experience on technological and environmental support for RE development

Country/ Region	**Description and Examples**
Australia	▪ Demonstration program: Renewable Energy Demonstration Program (REDP) is a competitive grant scheme established by the Australian Ministry of Resources and Energy to support the development of commercial scale ET projects, comprising geothermal, wave energy, and mini integrated projects involving wind technology, solar, biodiesel, and storage[34].
Europe	▪ The key driver behind most European countries to develop ET projects is to reduce their CO2 emissions due to international pressures on climate change and environmental conservation there are more concerns about the climate change issues and as substituents using low-carbon technologies.

- In Germany, for example, their goal of shutting down all the nuclear power plants by 2022 is another driving factor behind Germany's massive ET expansion[23].
- Carbon Market: This is the mechanism created after Kyoto Protocol where credit for GRK emissions is traded. This mechanism offers possibility for develop countries to meet CO2 reduction obligations indirectly. This can be done by buying excess credit from other countries, especially developing countries. In fact, this is a win-win situation, as developing countries are considered financially supportive and for developed countries, it helps lower costs to meet their environmental commitments[35].
- International funds: Climate funds are provided from international and regional entities, such as the World Bank, the Global Environment Facility, and regional development banks and are usually assisted by United Nations Development Program and United Nations Environment Program. These funds help Litbang's cooperation in promoting the development of new technologies[35].

4.2.6. Legislative Aspect

Looking at the nature of RES, the RE market provides a clear basis and legal framework for increasing the interest of investors. In fact, because of the characteristics of the RE generation and its higher cost as compared to other forms of power, the absence of a market is guaranteed for the power that can be agreed to enforce the feasibility of many RE projects[21]. That is why licensing instruments can help the RE market through various types that are related in two categories:

4.2.6.1. Power purchase legislations

There are various legal mechanisms that can be used to regulate purchasing power and provide support for a guaranteed ET market. But generally, there are two main mechanisms used by governments: Feed-In Rate (FIT) and tender arrangements. In addition, there have been recent developments in new initiatives to support the supply of electricity from renewable sources, namely the Renewable Portfolio Standard (RPS), the Green Price Scheme and the Green Certificate [21].

4.2.6.2. Grid access legislation

Easy access to the required network infrastructure is important for the success of the RE projects. Electricity that can be approved addresses the issue of grid access. In fact, RE projects are usually small-scale, centralized, and may be located in locations outside the city or far away where network connections are limited or unavailable. In addition, electricity generated from intermittent RESs, especially wind, photovoltaic (PV) and hydro, and this can attract penalties under several access lattices that impose tariffs, which beg for custodians that can produce acceptable and successful outputs[22].

4.3. Data Analysis

4.3.1. X-intercepts of Supply and Demand for Solar PV

Table 4.3 x-intercepts of Supply and Demand for Solar PV, Hydro and Wind

Area	TWh a	b			GWh c			d		
		PV	H	W	PV	H	W	PV	H	W
Africa	679	0.006	0.18	0.01	4670	127417	12280	0.18	0.56	0.41
China	5726	0.02	0.2	0.05	130659	1189840	295025	0.17	0.49	0.29
Europe	3396	0.03	0.18	0.11	129482	615403	384832	0.14	0.24	0.33
India	1179	0.02	0.12	0.04	26035	141801	51061	0.19	0.49	0.28
Pak	105.5	0.007	0.26	0.01	768	27925	2101	0.2	0.5	0.27
US	3884	0.02	0.08	0.07	87183	315619	277918	0.22	0.57	0.44

Table 4.4 x-intercepts of Supply and Demand for Solar PV, Hydro and Wind (Cont.)

Trillion $Pd = \frac{a}{b}$			Trillion $Ps = \frac{c}{d}$		
PV	H	W	PV	H	W
113167	3772.22	67900	25.9444	227.53	29.9512

286300	28630	114520	768.582	2428.24	1017.33
113200	18866.7	30872.7	924.871	2564.18	1166.16
58950	9825	29475	137.026	289.39	182.361
15071.4	405.769	10550	3.84	55.85	7.78148
194200	48550	55485.7	396.286	553.718	631.632

4.4. Supply and Demand Comparative Analysis

The curve between Energy and Price shows the best relation of electricity consumption as compared to renewable energy production of various countries with Pakistan. The curves can easily show the demand slope of various renewable sources and their effect can be seen by partial derivatives.

4.4.1. Impact on Equilibrium Price and its derivatives and its Result

For electricity demand, the values are positive for wind, hydro and solar energy, which shows if the electricity demand increases then the price is increased. In case of consumption factor, all the values are negative for wind, hydro and solar energy, which predicts that the price should be decreased so that the consumers feels benefited from the government policies and buy more renewable energy equipment. Now for the electricity supplied, the values are positive for wind, hydro and solar energy, which shows if the electricity supply is increased then the price is increased. In case of capacity factor, the values are negative for wind, hydro and solar energy, which predicts that the price should be decreased as the currently deployed production units are producing enough energy to meet energy requirements but in case of Pakistan compared with other countries the technology is not mature and not giving 100% efficiency, so we have to keep that matter into account and set the equilibrium price viewing all these factors and limitations also.

Table 4.5 Impact on Equilibrium Price and its derivatives due to Solar PV, Hydro and Wind

Area	a	b			GWh c			d			Trillion P'		
	TWh	**PV**	**H**	**W**	**PV**	**H**	**W**	**PV**	**H**	**W**	**PV**	**H**	**W**
Africa	679	0.006	0.18	0.01	4670	127417	12280	0.18	0.56	0.41	3675.64	1089.75	1645.90
China	5726	0.02	0.2	0.05	130659	1189840	295025	0.17	0.49	0.29	30824.52	10022.95	17708.8
Europe	3396	0.03	0.18	0.11	129482	615403	384832	0.14	0.24	0.33	20738.1	9550.95	8592.8
India	1179	0.02	0.12	0.04	26035	141801	51061	0.19	0.49	0.28	5738.26	2165.24	3843.94
Pak	105.5	0.007	0.26	0.01	768	27925	2101	0.2	0.5	0.27	513.37	175.55	384.28
US	3884	0.02	0.08	0.07	87183	315619	277918	0.22	0.57	0.44	16546.5	6460.95	8160.62

Table 4.6 Impact on Equilibrium Price and its derivatives due to Solar PV, Hydro and Wind (Cont.)

$\frac{\partial P'}{\partial a}$			$\frac{\partial P'}{\partial b}$			$\frac{\partial P'}{\partial c}$			$\frac{\partial P'}{\partial d}$		
PV	**H**	**W**	**PV**	**H**	**W**	**PV**	**H**	**W**	**PV**	**H**	**W**
5.37	1.35	2.38	-1.97×10^{16}	-1.47×10^{15}	-3.91×10^{15}	5.37	1.35	2.38	-1.97×10^{16}	-1.47×10^{15}	-3.91×10^{15}
5.26	1.44	2.94	-1.62×10^{17}	-1.45×10^{16}	-5.20×10^{16}	5.26	1.44	2.94	-1.62×10^{17}	-1.45×10^{16}	-5.20×10^{16}

5.88	2.38	2.27	-1.21×10^{17}	-2.27×10^{15}	-1.95×10^{16}	5.88	2.38	2.27	-1.21×10^{17}	-2.27×10^{15}	-1.95×10^{16}
4.76	1.63	3.12	-2.73×10^{16}	-3.54×10^{15}	-1.20×10^{16}	4.76	1.63	3.12	-2.73×10^{16}	-3.54×10^{15}	-1.20×10^{16}
4.8	1.31	3.57	-2.48×10^{15}	-2.30×10^{14}	-1.37×10^{15}	4.8	1.31	3.57	-2.48×10^{15}	-2.30×10^{14}	-1.37×10^{15}
4.16	1.53	1.96	-6.89×10^{16}	-9.9×10^{15}	-1.60×10^{16}	4.16	1.53	1.96	-6.89×10^{16}	-9.9×10^{15}	-1.60×10^{16}

4.4.2. Impact on Equilibrium Energy and its derivatives and its Result

For electricity demand, the values are positive for wind, hydro and solar energy, which shows if the electricity demand increases then the renewable energy is increased. In case of consumption factor, the values are negative for wind, hydro and solar energy, which predicts that the energy is decreased which is obvious because the more the energy is consumed the less the energy will be. For electricity supplied, the values are negative for wind, hydro and solar energy, which shows if the electricity supply is increased then the conventional energy is decreased. In case of capacity factor, the values are positive for wind, hydro and solar energy, which shows if the capacity factor increases then the energy is increased.

Table 4.7 Impact on Equilibrium Energy and its derivatives due to Solar PV, Hydro and Wind

Area	a		b			**GWh** c			d			**Trillion** E'	
	TWh	**PV**	**H**	**W**	**PV**	**H**	**W**	**PV**	**H**	**W**	**PV**	**H**	**W**
Africa	679	0.006	0.18	0.01	4670	127417	12280	0.18	0.56	0.41	656.94	482.84	662.54
China	5726	0.02	0.2	0.05	130659	1189840	295025	0.17	0.49	0.29	5109.50	3721.40	4840.55

Europe	3396	0.03	0.18	0.11	129482	615403	384832	0.14	0.24	0.33	2773.85	1676.82	2450.79
India	1179	0.02	0.12	0.04	26035	141801	51061	0.19	0.49	0.28	58812.9	919.17	1025.24
Pak	105.5	0.007	0.26	0.01	768	27925	2101	0.2	0.5	0.27	101.90	59.85	101.65
US	3884	0.02	0.08	0.07	87183	315619	277918	0.22	0.57	0.44	3.553.06	3367.1	3312.75

Table 4.8 Impact on Equilibrium Energy and its derivatives due to Solar PV, Hydro and Wind (Cont.)

$\frac{\partial E'}{\partial a}$			$\frac{\partial E'}{\partial b}$			$\frac{\partial E'}{\partial c}$			$\frac{\partial E'}{\partial d}$		
PV	**H**	**W**	**PV**	**H**	**W**	**PV**	**H**	**W**	**PV**	**H**	**W**
0.96	0.75	0.97	-3.55×10^{15}	-8.24×10^{14}	-1.60×10^{15}	-0.03	-0.24	-0.02	1.18×10^{14}	2.65×10^{14}	3.91×10^{13}
0.89	0.71	0.85	-2.75×10^{16}	-7.11×10^{15}	-1.51×10^{16}	-0.10	-0.28	-0.14	3.24×10^{15}	2.90×10^{15}	2.60×10^{15}
0.82	0.57	0.75	-1.70×10^{16}	-5.45×10^{15}	-6.44×10^{15}	-0.17	-0.42	-0.25	3.65×10^{15}	4.09×10^{14}	2.14×10^{15}
0.90	0.80	0.87	-5.19×10^{15}	-1.73×10^{15}	-3.36×10^{15}	-0.09	-0.19	-0.12	5.46×10^{14}	4.25×10^{14}	4.80×10^{14}
0.96	0.65	0.96	-4.96×10^{14}	-1.15×10^{14}	-3.70×10^{14}	-0.03	-0.34	-0.03	1.73×10^{13}	6.05×10^{13}	1.37×10^{13}
0.91	0.87	0.86	-1.51×10^{16}	-5.66×10^{15}	-7.04×10^{15}	-0.08	-0.12	-0.13	1.37×10^{15}	7.95×10^{14}	1.12×10^{15}

4.4.3. Supply and Demand curves

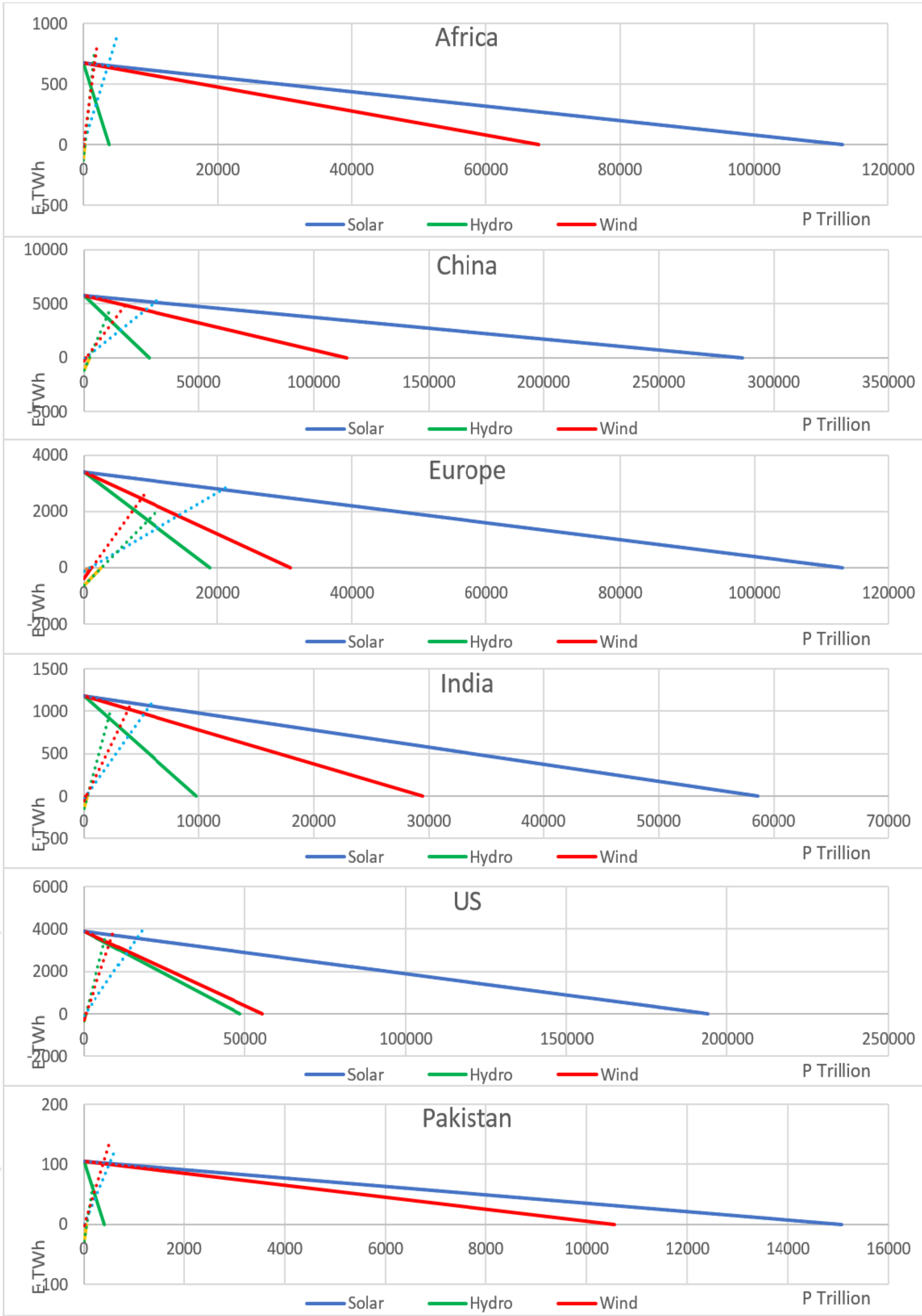

Figure 4.2 Comparison of Supply and Demand curve of Pakistan and other countries

4.5. Barriers, Planning and Strategies

Early investment costs, institutional weaknesses, management mismanagement, and lack of proper government policy are some of the major obstacles to solar energy development in the country. A fundamental framework is needed to promote solar technology for domestic and commercial applications to achieve long-term environmental and socio-economic benefits. The government has recently recognized the importance of solar power for improving socioeconomic conditions and for controlling environmental pollution[36]. Some of the suggested steps need to be taken for the development of new technologies:

- Incorporating solar energy technology into long-term national energy policy.
- Provision of sufficient resources to develop laboratory scale models for commercialization.
- Provide incentives to motivate entrepreneurs to develop and invest in renewable energy sources [37] and [38].
- Subsidies and loans to end users.
- Provide accurate field demonstrations, education and training to the community.
- Installation of sun lamps and other equipment in public places such as parks, streets, and schools [39].
- Adequate allocation of funds from national budgets to renewable energy institutions.
- Promoting the use of solar energy technology during public events such as stadium lighting using PV systems during major sports activities.

Many cases are needed to support development everywhere in the field of human endeavor. Summary of different challenges and important factors for developing a reliable solar power source including lay awareness, development and development, infrastructure development, commercialization, decentralized power delivery systems, market development, funding and broadcasting programs, government inclusion and distribution, resettlement and transfer use, update, and update all results and results that were appropriate for the period[36].

If possible, select sources that can be approved, may be cut down by various permits from the kingdom. Local PV cell discharges are allowed large PV technology releases which reduce the electrical charge generated. The main constraints in the development of PV technology are the uncertainty of local communities, the absence of technical information and a workforce base that cannot be supported[36].

PV technology is more suitable for download areas and small control applications such as Baluchistan, Sindh and Thar Desert. Baluchistan which has the largest region compared to other regions in Pakistan has a very small dense population (21 percent / km2). In this field PV technology is the only option that is most suitable for providing electricity to residents. Individual units can be installed for each house to meet the small power requirements of approximately 50-100 W per house. In the northern and western regions of Pakistan, the Hindu Kush-Himalaya (HKH) is blessed with lots of solar radiation (approximately 4-6 kWh / m2) and hours to repair the sun. In the 1980s, different agencies installed seven solar stations for village lighting in various parts of the HKH area. The total capacity of this system is approximately 234 kW[36].

Efforts have been made for local PV cell manufacturing and installation of small PV systems in Pakistan. Local fabrication capabilities are available only at Pakistan's Renewable Energy Technology Council (PCRET) but are still limited on a pilot scale. Siemens Pakistan has been actively involved in the PV business in Pakistan for over 10 years. They have installed complete solar systems for home electricity, water pumps, telecommunications, road communications, navigation, oil and gas fields and street lamps[36].

4.5.1. Barriers

To achieve progress everywhere in the world for human endeavors must take many steps under attention. There are many obstacles to the development of alternative technologies supported in literature. This may include market acceptance, technical acceptance, social acceptance and obstacles to political oversight[40]. The other half is specifically for overseas and markets while the other is technology.

4.5.1.1. Access to delivery

Workers must supply access to basic utilities and their access to delivery online is subject to high prices. Many alternative labor suppliers from end users who want to create a base to facilitate buyers access to end users[40].

4.5.1.2. Technical expertise

Pakistan is a country that is developing and overcoming technological lag. A source of energy that can be approved requires R & D received to release energy that encourages if the environment is competitive with the available fuel. One basis must be developed to send project-workers can be given to R & D organizations that are efficient in the ranking of institutions[40].

4.5.1.3. Investing capital

Investment is a major barrier in the development of any project. As an alternative energy supplier far from urbanization, they need higher investment in terms of installation, site management and to resolve other political issues. In the context of Pakistan There is a flow of financial aid from banks to the supply of labor[40].

4.5.1.4. Installation and construction restrictions

Some alternative energy projects face social and environmental security restrictions during installation processes such as high roof heating, high wind turbines, and biomass burning [41].

4.5.1.5. Lack of institutional coordination

Pakistan faces issues of coordination between countries. The governing body does not coordinate with sub-agencies efficiently. There should be a governing body to ensure coordination of the primary and sub / w councils[40].

4.5.1.6. Public awareness

Market errors and lack of public awareness are important barriers to the development of emerging technologies that present a poorer image of alternative technologies than conventional technologies in the context of costs and other benefits. Social and electronic media are the major sources of information, seminars and other useful activities should be focused on public awareness [42].

4.5.1.7. Evaluation of resources

The absence of easy resources is an important obstacle to the impasse in the development of alternative energy technologies. Pakistan is involved in providing data about accessible databases. Policies and monitoring agencies are required to update source management data such as available capacity, weather data, and geographic statistics[40].

4.5.1.8. Market failure

Many business barriers increase the productivity gap of emerging technologies, which may include lost motivators and lower spending [43]. In Pakistan there is a high risk of market failure that creates a continuous deadlock to adapt to alternative energy sources.

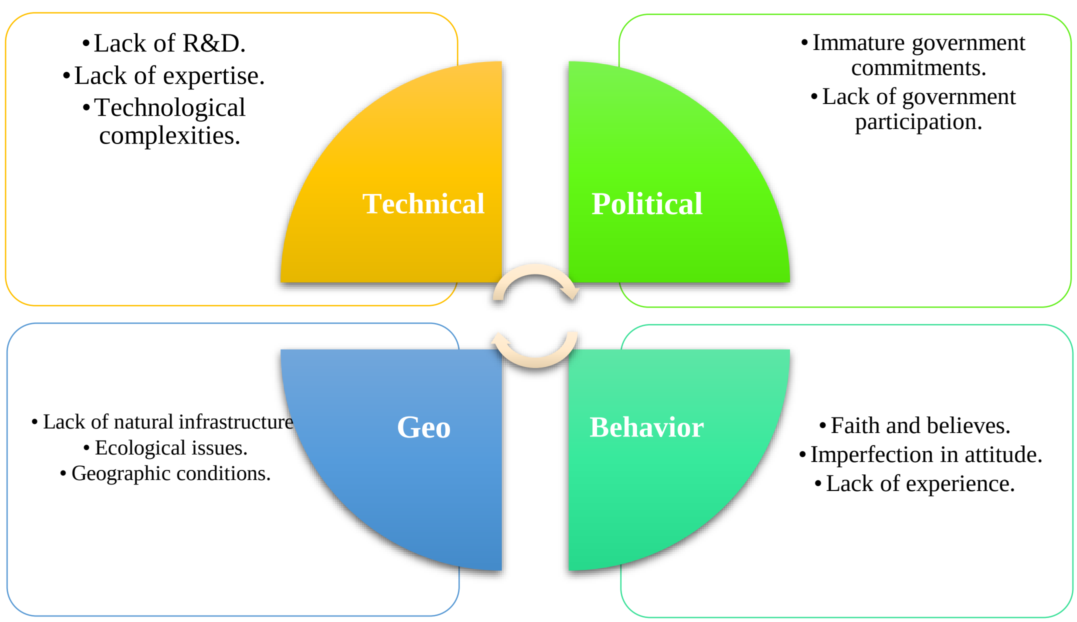

Figure 4.3 Barriers graphical representation

4.5.2. Challenges

Because the great potential and benefits in the discussion that are permitted, are obstacles in the ranking of nationalities and nomads, which must be overcome. One challenge is the low investment in labor that must be expended because it asks for a high initial capital cost, and benefits from the projects that need a future to be realized[44]. Following are the challenges in labor technology that can be approved:

4.5.2.1. Basic wise challenge

- Lack of incentives for private sector diversion and inconsistent basis.
- There is no bribery rate structure.
- A subsidiary of fossil fire materials.
- Weak environmental regulations.
- Low priority given to workers is permitted in country design and weak frameworks[44].

4.5.2.2. Technical Challenge

- Technical effort is limited to the acceptable form, arrangement, arrangement, regulation and addition of modern workers' services.
- Technological restraints for mapping that can be trusted and supported.
- Removal of localized special equipment.
- Poor technology.

4.5.2.3. Economic challenges

- Small economies of scale, high start-up capital, and long payback periods.
- Inadequate access to credit and royal financial support.
- Limited knowledge about market potential.
- Installation costs are high in the end-user ranking[44].
- High risks and risks.

4.5.2.4. Information and human resources

- Reduced sources and technologies of RE, EE, equipment suppliers, and required funding.
- Not enough information is available on the energy allowed and the energy capacity to create a basis and move civil society.
- Insufficient expertise in marketing management and marketing skills.
- Lack of expertise and service in the design of systems, installation, control and operation of permitted power technology and energy efficiency.
- Present at the capacity of the country to collect data, analysis and development of RE projects[44].

4.5.3. Renewable Policy Barriers

Some positive features of renewable energy policy have been discussed. Again, the same assurance remains that this activity is not suitable for significant development in the country's renewable sector. This is a direct result of the inability of renewable energy policies to successfully address a number of key issues, while these issues have also been recognized in the policy framework[45]. The challenges associated with renewable energy schemes are described in detail today.

4.5.3.1. Absence of competitiveness with conventional electricity generators

The lack of competitiveness of RE sources with conventional electric guards seems to be one of the reasons for the modest growth in this country. More than excise exclusions, electricity from RET remains more expensive than promised from crude oil. This may be discussed by a number of changers. First, GET a large capital cost compared to crude oil technology. One allows it to truly reserve that "if it were not for the greater investment involved in the production of photovoltaic cell power (PV) power plants in Pakistan, this technology would be an undeniable leader according to the economy" [46]. The absence of industrial units indicates that RET equipment needs to be imported, which in turn increases spending on purchasing power projects [47]. Another important reason for discussing crude oil is the subsidies and electricity produced by the lodge at a high price [48].

These elements play an important role in blocking the development of RET in this country, it will be developed critically here. One of the main reasons for subsidized crude oil is to protect local prices from volatile market variations worldwide [49]. Thus, the kingdom began a process to support local commerce for the public. And the people will also use technology that is more trusted and efficient in the nearest future [50]. For example, individuals will not look for ways to buy transportation or cuba that is obtained more than power devices if the cost of labor remains enduring for all time [45].

In addition, subsidies by the kingdom raised the cost of labor from crude oil down, putting the already expensive RET at an additional disadvantage. The interests of negative externalities must not be excluded. For example, simplicity and environmental costs combined with air pollution through crude oil are not thought to be the price of energy [51]. At the same time, positive advantages, for example, the social and ecological advantages of RET that are not dirty, are not represented equally. RET was pushed aside by this result. The subtle elements that speak of the critical components, taken together, brought by RET cannot succeed in competing with the usual methods of forced enforcement. In connection with the nature that energy technology can be agreed upon is excise excluded in conjunction with the 2006 workforce, this motivation should not encourage development that needs attention in any field that is successfully developed in the long term [52].

4.5.3.2. Market penetration & financial strategy about RETs

Market capitalization and RET penetration rates are relatively low compared to other conventional technologies. The reasons behind this slow progress are general awareness and competition with conventional power generators. It is almost impossible for RET to challenge the crude oil monopoly [53]. But he still made his place and gained public trust. Another important factor to consider, which hinders the development of RET is the absence of marketing and advertising strategies. To grow the RET market, a successful business strategy must be applied; otherwise, the RET market will not be able to develop and retain their competitors today [54]. Also, in Pakistan, there is no financial strategy to fund projects that can be effectively extended, just for small scale projects. This problem stems from a lack of proper knowledge of RET, and there is a greater risk of losing large investments due to unpredictable natural properties such as wind, water, and diesel. In addition, with relatively large expenditure on RETs in the early stages, investors were not profitable [55].

4.5.3.3. Lack of developed infrastructure

The main reason behind the stunted RET growth is the lack of infrastructure being built. Electricity needs in undeveloped regions of the country are much lower due to the absence of designed conduit channel structures [56]. To foster and provide electrical supplies to places like that is very cool and expensive. For example, to build lines of 220 kV, 132 kV and 220 kV the budget allocation is 7.5 million, 3 million and 0.2 million rupees / km respectively [57]. In Pakistan, the question that does not need to be questioned again about the electricity which often also causes major problems with electricity from RET [58]. So, in this situation, only projects that can be excluded can only be returned that can be returned electrical supplies to areas far and far away. Finished janitorial electric structures are usually decentralized, while conventional electrical infrastructure in Pakistan is centered in nature[45].

Another important infrastructure challenge is that RETs are usually centralized, while the electric power guarantee system during Pakistan was designed to perpetuate the need for a centralized system. The importance of infrastructure for a decentralized way of guaranteeing power deviates from a centralized power system and therefore, the existing system must be adjusted to support RET professionally and effectively [59]. Infrastructure related to the support market is also mandatory. Market support infrastructure regulates a series of sales and sales, service after sales and support technology [60]. The approved infrastructure will increase market growth, increase sustainability and lower guarantee generation projects [45].

4.5.3.4. Absence of skilled workforce & training facilities

To complete successful projects related to renewable energy, there is always a strong need for skilled labor. Currently, there is absolutely no skilled labor and technical training for the installation, commissioning, and maintenance of proper renewable projects. Expert energy and skilled labor from various technical institutions and universities are also required for research initiatives. It is also extremely difficult to achieve and maintain manufacturing units related to the latest technology, with no well-trained local workforce[45].

4.5.3.5. Limited organizational cooperation

The country has a weak background in communication and participation among various government agencies. Prior to the formation of the AEDB, no government administration unit was responsible for planning and developing renewable energy-related policies. Prior to PCRET, there were many different administrative agencies with weak and limited goals, for example. PCAT & NIST, who were dissolved to create PCRET due to their failure to cooperate. Lack of cooperation and participation between government agencies, organizations, ministries and creditors remains to this day [61].

AEDB and PCRET are two important government entities to accelerate and accelerate the growth of Pakistan's renewable sector, one entity's goal of designing and implementing other interim policies to develop and promote technology. In order to create innovative and innovative development, both organizations need to work together to achieve the same goals [62]. If the two organizations do not cooperate, then the research activities may be replicated and not useful for broad research purposes, because there is no shared information sharing mechanism [63]. Therefore, sharing and cooperation can be good for leading and capturing Pakistan's renewable sector [45].

4.5.3.6. Limited information & technology access

The lack of noticeable form to obtain contentious technical data about agreed technology, which, on the contrary, is a major obstacle in developing permitted labor projects. The absence of technical data to authorize and assess sources, for example, in collections related to air and wind flow [64]. This information access is important to increase investment interests and improve projects. Practical information related to technology that has been developed is also not widely accessible as a source of bank data, and the lack of knowledge that addresses technical and related costs [65]. Limited sources of information related to the provisions of the authorities and requests in the rankings used play a major role in obstructing development [66]. Commemorating the ultimate goal to commercialize

RET also requires the absence of data related to strengthening, quality and implementation of products that are never straight [67].

Practical exposure can be questioned by providing a systematic procedure for receiving notice. There is also information that is very important in accessing technology. In addition, no industry is distinguished from producing technology-related equipment that must be approved with equipment that must be purchased at a higher price than other countries and there is also a complete absence associated with this RET equipment [68]. In addition, workshops that provide inadequate equipment, and important cases such as those required to continue operations, cause equipment failure [69]. There are also no activities associated with discussions that are important in the field that can be approved, which actually hinder developments in the sector that can be supported [70]. The absence of a comprehensive endorsement platform that is structured hinders the growth of technology that can be approved in Pakistan [45].

4.5.3.7. Limited communal knowledge and endorsement

To complete successful projects related to renewable energy, there is always a strong need for skilled labor. Currently, there is absolutely no skilled labor and technical training for the installation, commissioning, and maintenance of proper renewable projects. Expert energy and skilled labor from various technical institutions and universities are also required for research initiatives. It is also extremely difficult to achieve and maintain manufacturing units related to the latest technology, with no well-trained local workforce[71]. Experimental knowledge and awareness relating to lectures and maintenance projects related to renewed electricity are also not suitable for people looking for alternative energy. The acceptance of this technology on the widespread roll is still not easy due to limited awareness and lay awareness [72].

To access land that is important from the point of view of a renewable workforce project is another communal obstacle to acceptable results. Pages that are perfect for producing electrical energy from the energetic can be given often in conventional places. By gaining trust and graduation busy people can bring extensive conversation and can request payment of important reparations [73]. Unquestionably, royal institutes tackle problems that cannot be overcome in serious trials to promote the use of RET. The agreed power base was introduced in 2006, however, many people stayed behind to be invited[45].

Figure 4.4 Existing barriers to alternative energy development in Pakistan [36].

4.6. The Way Forward in Pakistan:

Impressive progress has been made in global development and the use of top power, in the power sector, where, in the past five years, supported power has contributed to more than half the capacity of new power. The base must play an important role in realizing the market for the energy allowed and in spurring growth in usage. Nearly all countries have at least one energy target that can be agreed upon and the number of countries is implementing a base that has tripled more for 150 in 2004 and 2017.

Various police have been used to support the growth of energy can enlarge. The privileges of the police in certain countries depend on the maturity of the sector, specifically the market, and wider socio-economic conditions. Looking at the use of labor that has been developed and developed the sector has been developed, the basis must adapt and become more sophisticated to complement the broader workforce system - including the end use sector - and the effective transition of labor and a costly lodging. The broader base mix is also relevant to the state to see the socioeconomic dimension of labor migration. In addition to use, the combined basis permitted is issued basis relating to education and training, industry, labor, promotion of investment and R&D, among others.

The basics for power allow for temporary assistance, while support for renewal in the installation and cooling and transport sectors is less dynamic. Specific basis and steps to support the use of energy can be supportive in all sectors will be important to achieve the transfer of power in line with the objectives of the state and conservation.

Energy may be given may play an important role in the conquest of the provision of cash. Except to achieve this, the basis and specific steps required at the national and sub-national rank. These basics must reflect local conditions (eg building stock, demand for industrial profits, potential sources) and context-specific obstacles. Steps to support profit can be agreed to include:

Specific goals for innovation in heating and cooling and strategies for achieving goals. Mandates and obligations (e.g., for solar water heaters) to offer increased warranty of use. Building codes that meet energy performance requirements can also support renewable heating and cooling and are used to align energy efficiency with renewable heat needs.

Fiscal and financial incentives to reduce capital costs for renewable energy technologies, and to create playgrounds with fossil fuels. It can also be used to support the district's energy infrastructure, which will then enable the integration of various renewable heat options.

Hot-generation incentives, new additions to various policy tools, to provide long-term support.

Carbon / energy taxation provides important price signals and reduces external considerations, acknowledging that this may be difficult to implement politically, especially since the energy-intensive industry often benefits from exceptions.

Rapid changes in the energy field require a new way of classifying policies. Energy transition involves the transformation of the energy system and the socioeconomic structure on which it is built. Policies to support transitions need to adopt a holistic approach that contributes to these two dimensions. As some renewable energy has shifted from the niche to the mainstream, the transition-driven policies should include not only the use of renewable energy, but also their integration into a broader energy system and economically sound policies that impact sustainability and transition. The classification of renewable energy policies by three main categories1:

Direct policies and instruments are used to support the development and use of renewable energy technologies and products, in the general sense and in the context of expanding access to electricity and other forms of clean energy. These are usually classified as push, pull, and fiscal and financial. Ignore specific action policies such as electricity quotas, use of solar water heaters or biofuel mandates, rural electrification, and popularize clean or biogas cooking kitchens. Attract police to incentivize certain actions, e.g. through price or regulation. Fiscal and financial policies and instruments include tax incentives, grants and subsidies.

Integrate the basics of permitted labor use and labor capacity in the installation and cooling, transport and power subsector into the larger power and economic systems and into the daily lives of users. This category summarizes the basics for installing the necessary infrastructure development (for example, replacing deliveries and distribution, charging stations for electric vehicles, infrastructure enhancing the area), the basis for increasing system flexibility (appropriate, support for storing power supplies), to promote comparison and to promote comparison and to support experimentation, development and demonstration. Steps to promote the economy to support Steps taken to assist in the transition are also needed to ensure a shift in labor and tray for all.

Allow the base to contribute to a wider environment for development. This includes the basics that make clear statements to interested parties, measuring the playing field for renewal (for example, reforming fossil fuel subsidies, carbon price bases), managing land use, ensuring technological trustworthiness (for example, quality and technical expertise, sijil Access to appropriate financing in the rankings and support of labor market requirements (through direct steps and through education and training) The development of the local industry can be denied on an industrial basis (for example, using local capacities) and a trade basis (eg, trade agreements, export promotion Finally, the energy that can be expended can be supported through the basis and regulations of the natural surroundings and the environment.

Half a step can help in both allowing and integrating permitted power. This includes the establishment of self-help and senior institutional development institutions (eg, justified procedures that are packaged, dedicated to permitted workers), awareness programs to support behavior, and pooling of resources that can be supported by livelihood development. The basis for social protection for transition is also needed for the transition of sustainable labor.

Based on this study, several key obstacles have been overcome for widespread use of solar energy and technologically advanced technologies. It has been found that awareness of solar technology is limited in the country. According to him, it has been suggested that universities should take introductory courses in offering introductory and introductory courses on the design and development of this system that meet national energy needs. For example, NUST and the Lahore University of Management Sciences (LUMS) and the Faculty of Science and Engineering have offered a Renewable Energy Systems course to introduce students to the basics of PV and other solar-based technologies. Other major universities in Pakistan must also offer courses on the development and implementation of solar technology in the country[36].

Increasing population, materialistic lifestyles, and industrialization have put pressure on electricity utilities to provide more energy which is a true global phenomenon for Pakistan. The country's main power output is based on fossil fuels and its lack of imports has led to a direct reduction in power generation and subsequently disrupted all areas of human activity. Therefore, it is timely that Pakistan must work hard to improve energy through new, clean and renewable sources of energy. The potential of solar power in this country is far greater than the total electricity demand and thus can be properly and wisely addressed. According to the revised white book, the government has set a 5% target on energy distribution through renewable sources by 2030. Using the right solar resources can help build sustainable energy infrastructure, improve energy security, and reduce dependence on fossil fuels imported[36].

Summary

Early venture costs, institutional shortcomings, the executive's fumble, and the absence of appropriate government strategy are a portion of the significant obstructions to sun-powered energy improvement in the nation. It presents a rundown of different deterrents accessible for the improvement of sunlight-based energy innovation. An essential system is expected to advance sunlight-based innovation for homegrown and business applications to accomplish long haul natural and financial advantages. The administration has as of late perceived the significance of sun-oriented force for improving financial conditions and for controlling ecological contamination. Results from SWOT and PESTEL analysis have been also discussed briefly along with supply and demand results which also concludes expanding populace, materialistic ways of life, and industrialization have squeezed electric utilities to give more energy which is a worldwide marvel for Pakistan. The nation's fundamental force yield depends on petroleum products and its absence of imports has prompted an immediate decrease in power age and consequently disturbed all regions of human movement. Subsequently it is convenient that Pakistan must endeavor to improve energy through new, perfect and inexhaustible wellsprings of energy. The capability of sun-based force in this nation is far more noteworthy than the complete power interest and along these lines can be appropriately and shrewdly tended to. As indicated by the reconsidered white book, the administration has set a 5% focus on energy appropriation through inexhaustible sources by 2030. Utilizing the privilege sun powered assets can help fabricate reasonable energy framework, improve energy security, and lessen reliance on petroleum derivatives imported.

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CHAPTER 5

Recommendations and Conclusions

There should not be a perfect support scheme for RE development that can be recommended in general. However, after discussing different experiences on the basis of promoting RE development, some actions that need to be taken and actions to be avoided may be carried out.

For those who support funding to shake and support those who favor RE, a strong willingness from the kingdom must be ensured, not only to channel funds, but also to make them healthy through diversion fees taken to perpetuate sustainability. In fact, if the recovery system is not established, the entities of long-term subsidy recipients will be exposed to critical financial negotiations and will fail to maintain their operational efficiency. In addition, it is important to call for an appropriate role in subsidizing, successful targets can be achieved.

Regarding loans, the role of the kingdom is also important for financial support that triumphs in RE. In fact, the first steps of the kingdom from a recovered loan such as a revolving fund or collateral can help encourage bankers to provide more funds for RET and thereby overcome the problem by investing in RET. The kingdom can also support its freedom in micro-loans, especially for stand-alone systems. In addition, easy loans and long-term loans are two characteristics that help promote investors.

There are several benefits of the FIT mechanism that can be summarized, such as:

- Provide higher prices to generators to drive increased ET supply to the network;
- Ensuring a shorter payment period for small and medium-sized investments;
- Avoiding the monopoly market of large companies by eliminating market barriers for small investors;
- Be a flexible system that can be designed for RETs, different market structures, locations, and price adjustments, as needed after a given period;

- Having a yearly return guarantee for investors will reduce the risk of the project.
- However, rates aren't always easy to determine at first because it's not always possible to know the true cost.

To solve this problem, a procedure can be found to know the price of RES before using FIT.

Finally, additional cost recovery mechanisms either through budget financing or through end-to-end users using the same payment, can help companies reduce costs and encourage them to buy electricity from renewable energy even after fulfilling their obligations.

Competitive bidding mechanisms are considered the most profitable policy for end users and governments, as they lower prices through market-based pricing, which promotes minimum cost technology. However, this may present a risk of unsuccessful price bidding. In fact, very low energy prices act on investor motivation and send bad signals to the industry.

Excise tax on investment can reduce operational efficiency. In fact, after obtaining the benefits of an investment in excise credit, the owner will lose interest in the operation and operation of the RE logistics system, which loses the factor of capacity utilization. Therefore, better incentive transfers are excise credits, which encourage dwellers to impress operations to produce more electric power.

For successful tax support, a basic excise tax with a rigorous enforcement structure and a good system of administration is needed. They will not only help create efficient incentives but can also issue issues related to excise payments and not promote bad practices.

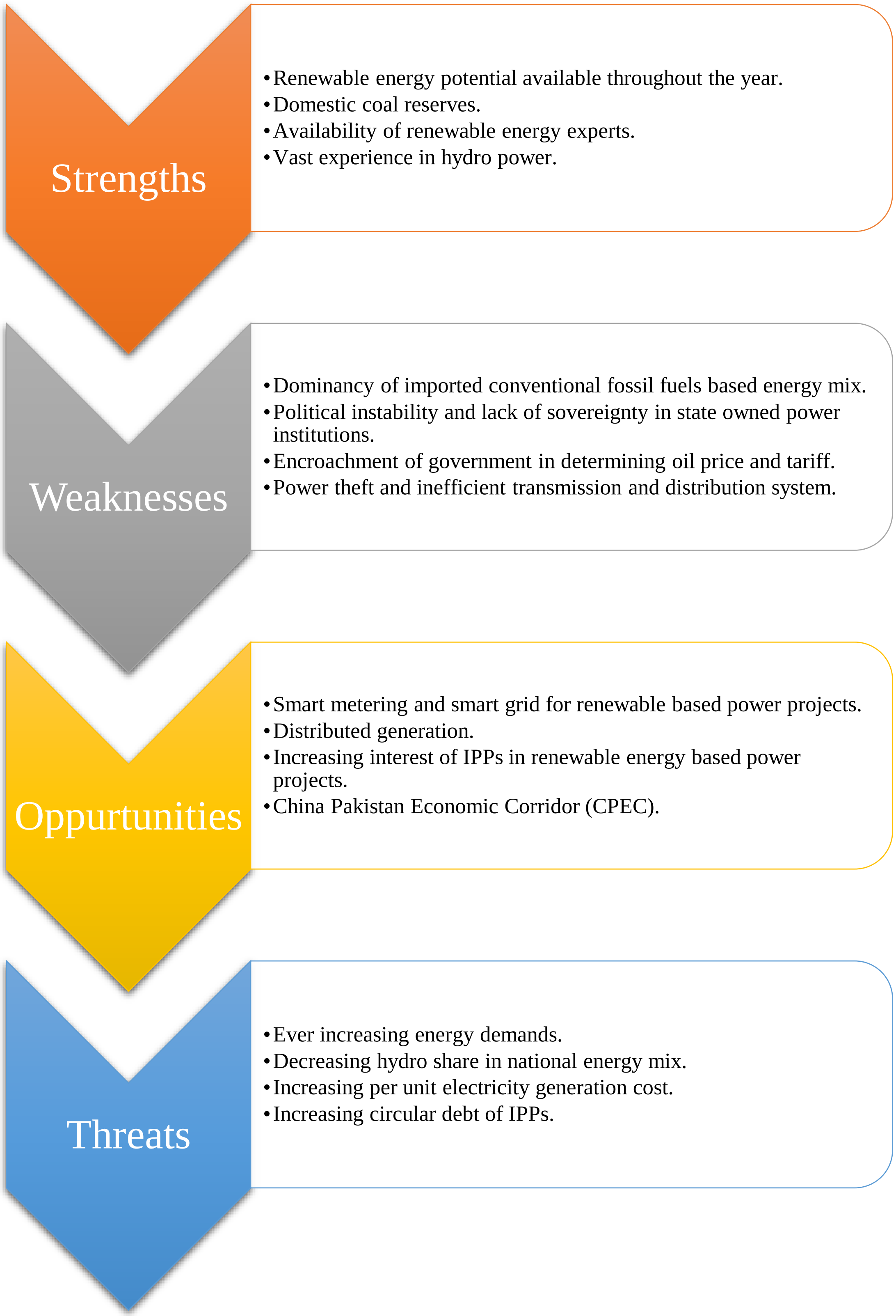

Figure 5.1 Conclusion of SWOT analysis of Pakistan's Renewable Energy Policies

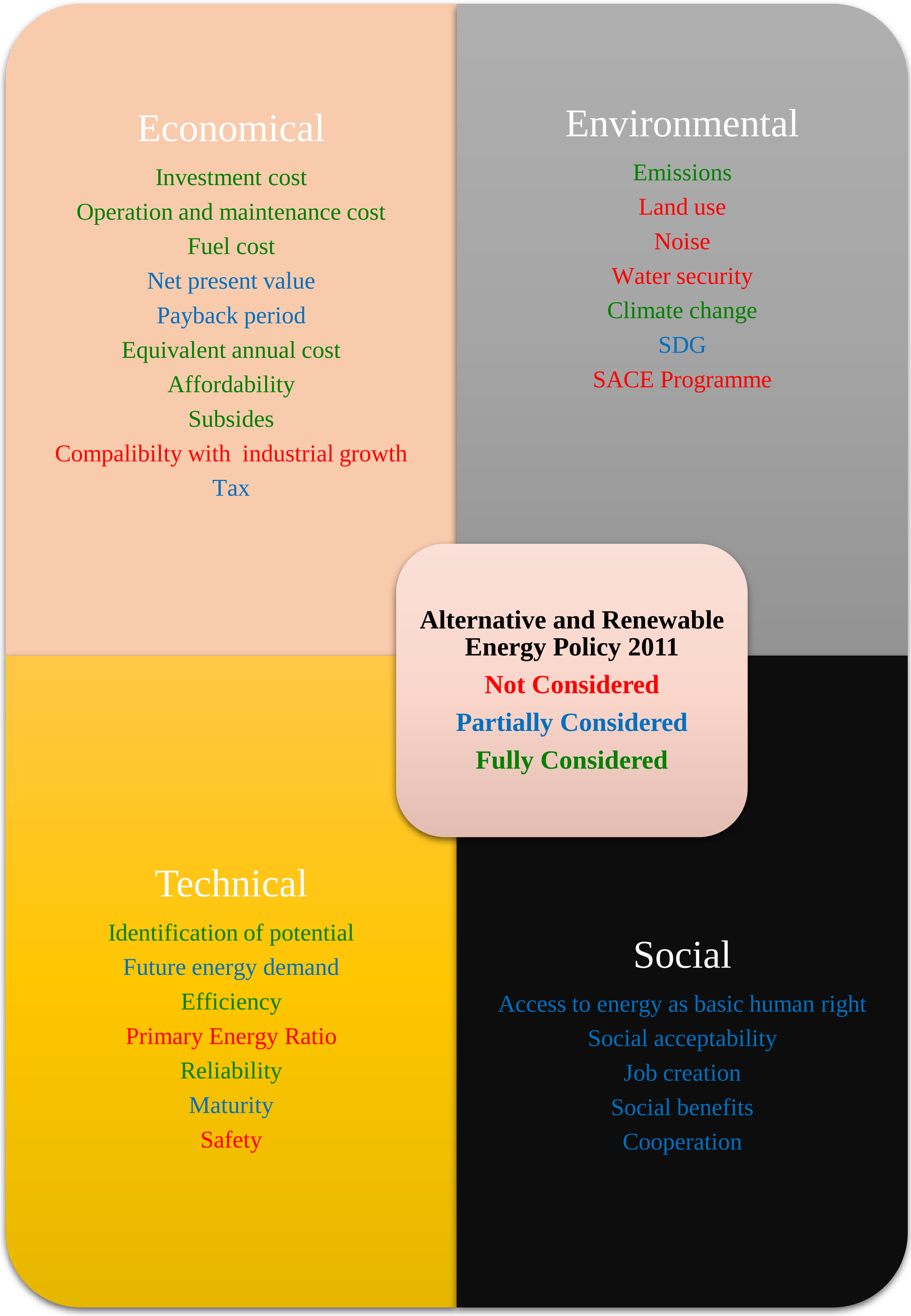

Figure 5.2 Conclusion of Alternative and Renewable Energy Policy Analysis

Figure 5.3 Conclusion of National Power Policy 2013 Analysis

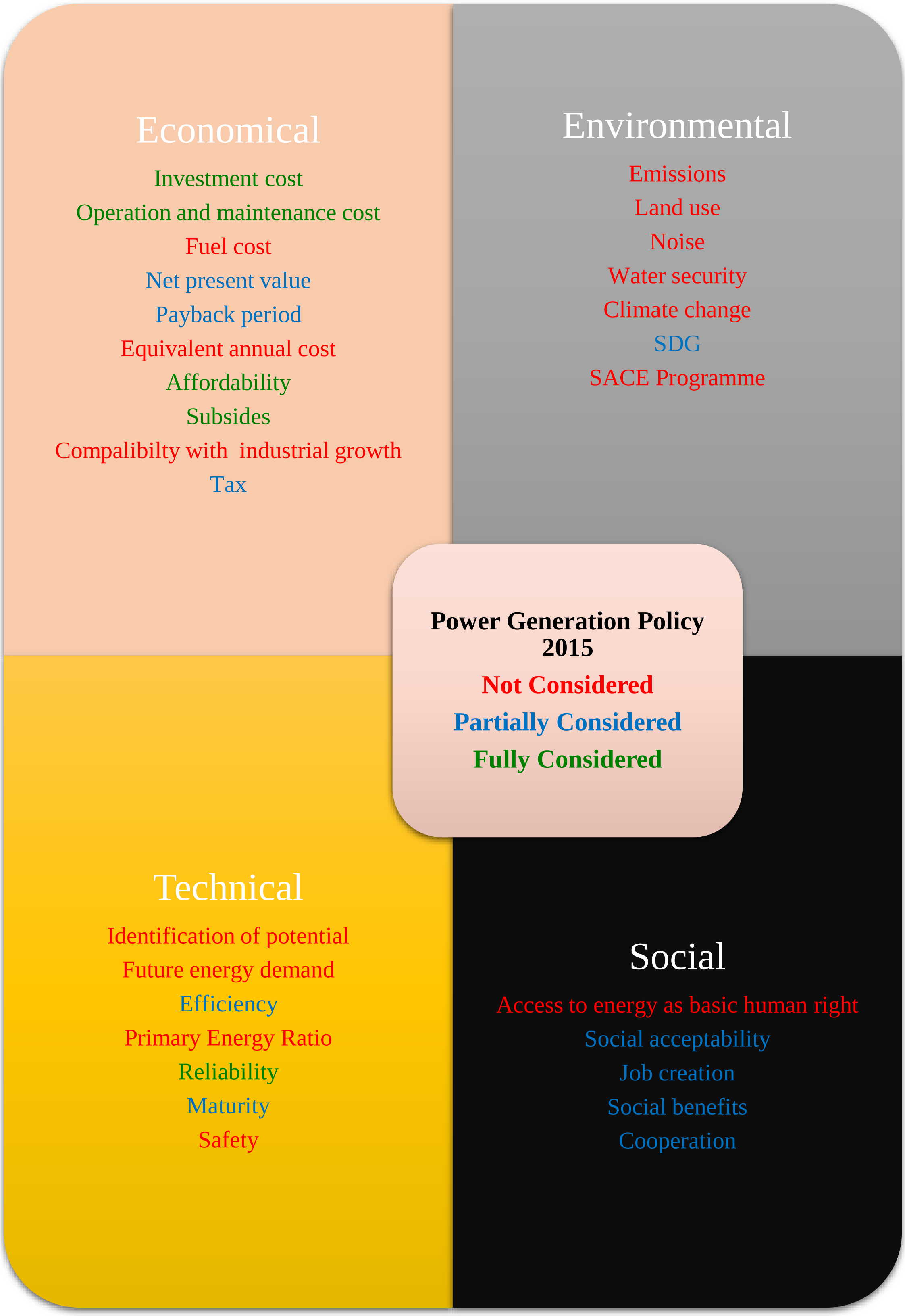

Figure 5.4 Conclusion of Power Generation Policy Analysis

The breakthrough of RE has proven its success in many countries of the world and is increasingly a key component of the energy mix in future plans for other countries.

However, such a basic transition must face many challenges with the penetration of a certain percentage of RE into the power system. In fact, most energy systems today are based on a centralized conception of big companies and therefore developing remote RE systems will be the first obstacle to overcome.

In addition, technical challenges will be created with ET projects such as frequency variations and low power factors caused by RES doubts. In fact, weak power networks often cannot cope with the fluctuations of the load from renewable electricity. These barriers are reflected in the ET market with high cost of ET projects compared to conventional energy projects. However, cost competitiveness for RES is expected to increase in the coming years due to technological and economic development.

Through this article, some examples of successful implementation of ET projects are explored by reporting case studies and analysis of key countries and activities. The experience described will surely help policy makers and executives learn from their experience and choose the best mechanism for each country's specifications.

has proven to be the best policy approach for increasing the percentage of electricity from renewable energy. These basic tools create healthy competition between power generators. The introduction of disco (FIT) in the social sector of Pakistan can bring about positive changes in the use of renewable energy projects. Clearly, to diversify our renewable energy facilities in Pakistan, market growth is crucial. And the Government can contribute a lot to energy efficiency. A simple approach to expanding the market 'on the use of renewable energy technologies quickly and effectively' is to exploit RETs in government buildings. Surprisingly, Australia and Germany have adopted this approach practically.

Government organizations such as AEDB and PCRET can increase their efficiency and increase by sharing information clearly and harmoniously. During this time, PCRET relied on Solar, Thermal, hydro and Biogas technology; In addition, to add wind and solar PV systems, the range should be added to the PCRET. If PCRET and AED are made, they are fully collected can add to the unique expertise and intuition that will help both goals achieve the same light. The trial information obtained from the use of projects in the field can be put to rest by PCRET, and the AEDB can build the best foundation using this information as input. To deal with problems involving this country, this process is likely to make more available screening grounds. RET investment must be provided to motivate, strengthen, and support the distribution of projects in Pakistan. To strengthen investment in RET and to actively encourage the use of technology, financial and domestic mechanisms need to be fully developed. Governments, in addition to subsidies, should initiate clear funding programs to support investors interested in micro RET projects. In addition, the Government can sincerely persuade donors and improve institutions to provide funding to banks so that IPPs can be successfully implemented. After receiving the funds successfully, the Bank will withdraw the funds to the Renewable Energy IPP. It is important to note that from supply and demand comparative mathematical model the values are negative for consumption factor indicating that the equilibrium price and energy should be decreased so that the consumers feels benefited from the government policies and buy more renewable energy equipment as well as for capacity factor the values are negative for equilibrium price which predicts that the price should be decreased as the currently deployed production units are producing enough energy to meet energy requirements but in case of Pakistan compared with other countries the technology is not mature and not giving 100% efficiency, and positive for equilibrium energy. To achieve the development of labor projects in Pakistan, access to information and technology related to RET must be renewed by its principles. To start this, the agreed structure of the data center must be fostered appropriately, and it must be entitled to features such as easy access to directions. Get the right information and right for development. RET also provides sophisticated manufacturing facilities and a training center. Thus, our dependence on foreign aid will be reduced. This is the first and foremost task of universities in Pakistan to play an important role in the development of RETs by Programs, workshops and seminars to familiarize the University's graduates with renewable energy.

APPENDIX A: RESEARCH ARTICLE

Comparative Study of Renewable Energy Policies of Pakistan with World

Abstract:

This paper discusses the correlation of public approach measures on sustainable power source (RE) in power age in Pakistan with the world. Utilizing a mix of new informational indexes and longitudinal exploration plans, this examines the effect of various strategy steps in an example of both created and immature nations to propose a powerful approach blend that can conquer market disappointments for clean vitality. The outcomes require exceptional innovation strategies that consider genuine economic situations and mechanical development. To improve institutional speculation conditions, the proposed arrangement instruments incorporate monetary and financial motivating forces, particularly for less develop innovation. Likewise incorporates SWOT and PESTEL investigation alongside gracefully and request numerical model and bends to look out for petroleum product through serious space for positive and negative contemplations identified with what can be conceded to joining is positive and negative results of sustainable power source. These strategy steps straightforwardly influence the structure of danger and profit for RE ventures. Supplementing this with administrative estimates, for example, codes and principles (for example AEDB and NEPRA) and long-haul vital arranging can additionally fortify the RE.