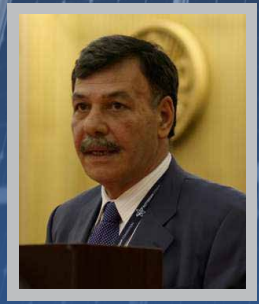
DEVELOPMENT OF RENEWABLE ENERGY IN PAKISTAN: PROSPECTS AND CHALLENGES



Ambassador
Shafkat Kakakhel (Retd)

ABSTRACT

Renewable sources of energy refer to sources that are naturally replenished such as water, sunshine, wind, biomass, and geothermal heat that are increasingly preferred as alternatives to fossil fuels such as coal, oil, and gas, which cause release of carbon dioxide and other greenhouse gases recognized as the main driver of climate change.

Other than hydropower which was the only source of electricity generation in Pakistan during the first three decades since independence, Pakistan is a new comer in the field of renewable energy. However, it has made significant headway during the past decade and a half in developing policies and institutions for promoting the development and deployment of renewable energy.

This paper describes the evolution of renewable energy in Pakistan from the prism of climate change and argues that by obtaining energy from clean, renewable sources Pakistan will be able to fulfill its obligations under the United Nations Climate Change Convention of 1992 and the Paris Agreement (2015) to reduce its carbon emissions, in addition securing significant financial, environmental and health benefits.

Keywords: Energy, Water, Renewable and Climate.

Rural to urban migration led to overcrowded cities with poor or no sewerage and sanitation, long hours of work by workers in factories producing or using hazardous chemicals, increased air and water pollution causing waterborne diseases in cities and towns

Introduction

Energy and development are mutually interdependent. Energy derived from fossil fuels had facilitated the advent of the Industrial Revolution in Europe (from 1780 onward) which marked the historic transformation of the predominantly rural communities engaged in basic farming and artisan manufacturing into urban communities producing ever growing quantities of textiles and other goods in factories powered by coal. Discovery, development and deployment of an array of energy sources since the 19th century have played a crucial role in spurring industrialization and modern agriculture, overcoming severe weather constraints, promoting education and scientific research, health education, care and production of vaccines, medicines and medical equipment and hospitals. Major advances were made in transportation, railways, shipping and aviation promoting global trade on a scale not seen before.

While until recently coal remained the largest source of energy for all uses, since the 20th century we have seen the invention, discovery and development as well as utilization of a range of new energy sources such as oil, and electricity generated by hydropower, solar photovoltaic, and more recently, wind and geothermal energy. The second half of the 20th century also saw large amounts of electricity generated by around four hundred nuclear power plants in thirty countries in all regions except Latin America. The Intergovernmental Panel on Climate Change (IPCC) - which had shied away from accepting nuclear power generation as environmentally sound for two and a half decades because of the problem of nuclear waste as well as security imperatives- finally legitimized it as a renewable source in its fifth assessment report (AR5) in 2014.

Whilst the effects of industrialization have been overwhelmingly positive in terms of extending life spans and improving living conditions, energy- driven industrialization and urbanization have also had serious negative consequences. Rural to urban migration led to overcrowded cities with poor or no sewerage and sanitation, long hours of work by workers in factories producing or using hazardous chemicals, increased air and water pollution causing waterborne diseases in cities and towns. Wastage of raw material in unsustainable production generated growing waste, which was left untreated causing life threatening pollution. Domestic and industrial waste was freely dumped into rivers, lakes, ponds, and other watercourses which caused their biological collapse. Governments had to adopt an array of preventive and remedial measures, including legislation, for enforcing proper waste disposal and curbing pollution.

Dozens of countries, especially those having coal deposits set up factories powered by coal or used coal for producing electricity

Given the indispensable role of energy, largely derived from fossil fuels, in promoting economic development and improved quality of life of citizens in industrialized countries.

Governments of the newly independent nations made determined efforts to produce and install electricity and procure oil and gas for industrialization. The discovery of huge quantities of oil and natural gas in the Persian Gulf and other regions of the world have enabled easy access to petrol and diesel, and the production and use of all types of transport vehicles as well as heating and cooling at homes running factories, hospitals, and schools. Dozens of countries, especially those having coal deposits set up factories powered by coal or used coal for producing electricity.

The 1980s saw an emerging consensus among North American and European scientists and climatologists on a palpable, measurable increase in

The UN Climate Convention upheld the scientific consensus that climate change had been caused by the release and build- up of greenhouse gases (GHG) emissions, mainly by the three dozen industrialized countries and obliged them to take the lead in reducing the emissions in order to stabilize the climate

surface and ocean temperatures. Their investigations convinced them that the increase in temperature had been caused by the accumulation of huge quantities of greenhouse gases, such as carbon dioxide, methane and nitrous dioxide in the atmosphere due to the burning of fossil fuels for producing energy since the start of the Industrial Revolution. Scientists believed that the increase in temperature and destabilization of climate compared to pre-industrial times posed serious risks to humankind and the natural biosphere and eco-systems.

Evolution of the Global Climate Change Agenda

In 1988, the UN Environment Program (UNEP) and the World Metrological Organization (WMO) jointly established the Inter-governmental Panel on Climate Change (IPCC) to assess the scientific, technical, and socio- economic information relevant for the understanding of the risk of human-induced climate change, its potential impacts and options for mitigation and adaptation. Scores of scientists and economists from all parts of the world contributed to the work of the IPCC.[1]

The first report of the IPCC issued in 1990 served to inform the inter-governmental negotiations convened by the UN General Assembly on climate change, which culminated at the UN Conference on Environment and Development (UNCED) held in Rio (Brazil) in June 1992 with the adoption of the United Nations Framework Convention on Climate Change (UNFCCC). The Convention came into effect in 1994 and remains the essential basis of the global Climate Agenda. The UNFCC Secretariat organizes annual meetings of the Conference of Parties (COPs) of the Convention which are attended by thousands of delegates representing governments, international organizations, energy industry, and civil society.

The Kyoto Protocol triggered efforts by the international community to reduce carbon emissions through enhanced energy use efficiency as well as development of carbon- free renewable sources of energy such as solar photo voltaic, wind energy produced by turbines on land, as well as off shore, and biomass

The UN Climate Convention upheld the scientific consensus that climate change had been caused by the release and build-up of greenhouse gases (GHG) emissions, mainly by the three dozen industrialized countries and obliged them to take the lead in reducing the emissions in order to stabilize the climate. Developed countries also agreed to provide financial, technical and technological assistance to the developing countries to adapt to the negative effects of climate change on their economies and adopt climate - friendly energy policies.[2]

The adoption of the UNFCCC triggered an explosion of activities throughout the world concerning climate change, including the establishment of climate research centers in the developed countries and greater attention being paid to climate change by the ministries of environment and foreign affairs, and closer consultations among governments in Europe as well as North America on matters relating to climate change.

The first agreement (Protocol) for implementing the UNFCCC was adopted in December 1997 in the Japanese city of Kyoto and bearing its name where, by thirty eight (38) developed countries agreed to reduce their GHG emissions by an average of 5% below the 1990 level, by 2012 before a new agreement is put in place. (The United States did not ratify the Protocol).[3]

The Kyoto Protocol triggered efforts by the international community to reduce carbon emissions through enhanced energy use efficiency as well as development of carbon-free renewable sources of energy such as solar photo voltaic, wind energy produced by turbines on land as well as off shore, and biomass. Governments encouraged greater investments in research on reducing the cost of production and improving storage, and transmission and distribution of renewable energy such as solar and wind. At the global level, governments established institutions such as the International Renewable Energy Agency (IRENA based in Abu Dhabi) to assist

During the past decade or so, the cost of producing all kinds of renewable energy has gone down while significant progress has been made in storage of solar and wind power, given the intermittent nature of solar and wind energy

developing countries in promoting development and utilization of renewable energy. The international finance institutions such as the World Bank and Regional Development Banks supplemented funding by some developed countries for enabling developing countries to increase their use of renewable energy. Development assistance decisions were increasingly shaped by climate change-related imperatives.

During the past decade or so, the cost of producing all kinds of renewable energy has gone down while significant progress has been made in storage of solar and wind power, given the intermittent nature of solar and wind energy. However, carbon emissions globally have increased unabatedly. Meanwhile, the number of extreme weather events such as hurricanes, heat waves, floods and droughts in all parts of the world linked by the scientists to climate change has also grown exponentially. The average global surface temperature has gone up by one degree Celsius.[4]

The Paris Climate Change Agreement (2015)

The third and most recent international agreement on climate change was adopted by representatives of around 195 UN member states at the twenty first (21st) conference of parties to the UNFCCC (COP 21) held in Paris.The Paris Agreement deals with the key elements of global climate action, namely mitigation, adaptation, finance, technology development and transfer, support to developing countries for building their capacities, and international cooperation on climate related matters.[5]

The Paris Agreement's provisions concerning mitigation represent a major deviation from the UNFCC. Under the Convention, thirty eight advanced countries had made a legally binding commitment to carry out major reductions in their carbon emissions, while developing countries were expected to adopt climate friendly development trajectory on a voluntary basis that would not entail large GHG emissions. The Paris Agreement requires reductions in GHG emissions by all countries-developed or developing, large or small, that have ratified the Agreement according to quantities and arrangements determined by them

The Paris Agreement also established mechanisms for promoting capacity development and facilitating development and transfer of technology to developing countries

according to their national circumstances. All parties were to formally notify to the UN their carbon reductions, described as Intended Nationally Determined Contributions (INDCs) in 2015, to be revised upward subsequently. The mitigation measures promised in the INDCs are subject to monitoring and verification according to agreed global procedures.[6]

The Paris Agreement formally established the mechanisms of global climate action that had been agreed during the annual meetings of parties to the UNFCC. These included the Green Climate Fund (GCF) for which the developed countries pledged to collectively mobilize USD 100 billion annually. The GCF was to become fully operational from 2020 onward. The agreement also maintained the Adaptation Fund established earlier but did not approve any additional funding for it.

The Paris Agreement also established mechanisms for promoting capacity development and facilitating development and transfer of technology to developing countries.

Notably, during the COP 21, participating governments and multilateral agencies announced the establishment of dozens of partnerships for climate change-related cooperation. One of the partnerships

World leaders at 2015 UN Climate Change Conference at Paris

Mangla Dam Pakistan

relating to renewable energy- the International Solar Alliance- was jointly launched by France and India. The ISA aims at setting the ground rules, norms and standards of solar energy in order to facilitate a rapid and massive deployment of solar energy in countries that are rich in solar resources but have not yet developed them.[7]

The Sustainable Development Goals and Targets Concerning Energy

A special session of the UN General Assembly held in New York in September 2015 approved a set of goals and targets called Sustainable Development Goals (SDGs) which had been intergovernmentally negotiated over two years and represents the UN's 2030 Development Agenda.

SDG 7 defines the global energy goals as follows:

- By 2030, ensure universal access to affordable and reliable modern energy services.
- By 2030, increase substantially the share of renewable energy in the global energy mix. The three targets related to SDG 7 are:

  - **Target 7.1**

    "By 2030, ensure universal access to affordable, reliable, and modern energy services".

  - **Target 7.2**

    "By 2030, increase substantially the share of renewable energy in the global energy mix".

Civil works linked to the Indo- Pakistan Indus Waters Treaty were meant to compensate Pakistan for the permanent loss of three eastern rivers, which had irrigated most of its irrigated lands but had been allocated to India

  - **Target 7.3**

    "By 2030 double the global rate of improvement in energy efficiency. The International Energy Agency (IEA). The International Renewable Energy Agency (IRENA), the UN Statistics Division , the World Bank, the World Health Organization (WHO) and the Energy Sector Management Assistance Program will serve as the designated custodian agencies for the achievement of SDG 7".[8]

Pakistan' Energy Landscape: an Overview

At independence, Pakistan had a total power generation capacity of Sixty (60) MW in the public sector. By the time it established the Water and Power Development Authority (WAPDA) in 1959, it's electricity production capacity had gone up to 119 which increased further when the Warsak Dam on the Kabul River near Peshawar funded by Canada became operational. Pakistan built its first large hydropower project whose power generating capacity at present stands at 1310 MW in 1967 in Mangla on the Jhelum River. The dam was part of civil works linked to the Indo-Pakistan Indus Waters Treaty (signed in September 1960). The civil works (dams, barrages, link canals) were meant to compensate Pakistan for the permanent loss of three eastern rivers, which had irrigated most of its irrigated lands but had been allocated to India. The electricity produced by hydropower plants on the dams came as a much welcome gift. Subsequently a second, larger hydropower dam along the Indus in Tarbela with a total

Demand for electricity grew at a feverish speed during the period 1990-91 to 2004/5 as a result of population explosion accompanied by urbanization, industrialization, large scale use of electricity in households and the farming and transport sectors

According to some experts, electricity generation projects constituted three-quarters of the CPEC Phase 1 portfolio and coal- based power producing projects formed three quarters of the energy projects

capacity at present of 3478 MW was completed in 1976. The Tarbela multipurpose dam was also funded from the Indus Basin Fund established under the Indus Waters Treaty. Meanwhile, Pakistan had discovered large natural gas deposits initially in a place called Sui in Balochistan and subsequently in Punjab, Sindh, and more recently in Khyber Pakhtunkhwa. Natural Gas has made large addition to Pakistan's energy stock but its production has not kept pace with either demand or distribution capacity. By end 1994, electricity generation capacity had gone up to 11000 MW.

Demand for electricity grew at a feverish speed during the period 1990-91 to 2004/5 as a result of population explosion accompanied by urbanization, industrialization, large scale use of electricity in households and the farming and transport sectors. Pakistan began to experience shortages of electricity supply during 2005-6; the demand- supply gap reached 15% in 2008 leading to power outages called "load shedding". The energy deficit adversely affected the industrial sector and forced a large number of textile factories to ease production or relocate to Bangladesh.

The Government resorted to a range of measures to increase electricity production, including the inclusion of coal-based power generation in the first phase of the development of the China Pakistan Economic Corridor (CPEC). According to some experts, electricity generation projects constituted three-quarters of the CPEC Phase 1 portfolio and coal- based power producing projects formed three quarters of the energy projects.

Electricity generation capacity has reached 35000 MW and is growing.There is no let up in efforts to augment electricity generation.Demand for power is expected to grow 9% annually while the country's domestic natural gas production is depleting rapidly.[9]

Efforts by Pakistan to Promote Alternative and Renewable Energy Resources

The establishment of the Alternative and Renewable Energy Development Board (AEDB) in May 2003 as an autonomous statutory body marks the start of efforts by Pakistan to develop and deploy alternative and renewable energy in Pakistan. The AEDB's mandate was to develop policies, programs, and projects for development of alternative and renewable energy through the private sector and to encourage transfer of technology and local manufacturing of renewable energy equipment. In 2006 AEDB was placed under the Ministry of Water and Power. The same year the Government issued the country's first 'Policy for Development of Renewable Energy for Power Generation'. The objectives of the policy were:

- Increase deployment of renewable energy technologies.
- Promote private sector investment in renewable energy technology through incentives and by developing a renewable energy market.
- Develop measures to mobilize financing for renewable energy projects.
- Facilitate the development of domestic manufacturing capacity of technologies for renewable energy in order to reduce costs of production, improve service while generating employment and enhancing local technical skills.
- Increase per capita energy consumption and social welfare, especially in the remote rural areas where poverty can be alleviated and the burden on women for collecting biomass fuel can be reduced.
- Promote protection of the environment.[10]

The 2006 AED Policy invited private investors to submit proposals in the following categories:

- For selling power to the grid exclusively (IPP Projects)
- For self use as well as sale to the grid.
- For small scale stand alone projects.

China Power Hub Generation Company's (CPHGC) 1320MW coal-fired power project in Balochistan under the CPEC is now operational

Pakistan hosted the first ever Renewable Energy Summit on August 26-27, 2019 in Islamabad in collaboration with the World Wind Association and the Global 100% RE Platform

The new targets for renewable energy include generating 8000 MW of electricity by 2025 and 20000 by 2030 representing 20 and 30% of Pakistan's energy from renewable sources

The Policy mentioned that no agreements or approval of government was needed for producing energy from renewable sources. Moreover, the import of equipment for renewable energy projects was exempted from payment of custom duty. Profits by the investment was exempted from Income Tax.

According to the 2006 Renewable Energy Policy investors were expected to focus on small hydro (up to 50 MW), solar photovoltaic and Thermal wind power. The production target was 9700MW by 2030 representing 10% of the total stock in the country.

The 2006 ARE policy offered several fiscal and financial incentives to investors.These included: provision of grid connection and interconnection by the power purchaser; guaranteed market through mandatory purchase of all electricity; exemption from all taxes and levies, and repatriation of equity along with dividends freely allowed subject to rules and regulations issued by the State Bank of Pakistan.

Despite its limited capacity, the AEDB has promoted over 145 renewable energy projects, including 15 wind plants producing 782 MW of electricity and concluded 11 new agreements for wind energy.The AEDB also played an important role in promoting the multiple benefits of renewable energy, especially solar, wind, small hydro, and biomass.[11]

Pakistan Vision 2025

In 2014 the Government developed a long-term development blue-print called Pakistan Vision 2025, which contained goals and targets relating to various sectors of the economy and major elements of socio-economic development. The Vision document set twenty five (25) goals to be achieved by 2025.The goals related to energy are noted below:

- Increase energy generation to 45000 MW by 2025 to provide uninterrupted and affordable electricity and increase electricity access from 57% to 90% of the population by 2025.
- Achieve a 25% reduction in the per unit cost of production by improving energy mix and reducing distribution losses.
- Increase share of indigenous sources of power generation to 50%.
- Neither the government which had spearheaded the crafting of the Vision 2025 document nor its successor seems to have integrated the objectives, goals and targets enshrined in the blueprint in their budgetary allocations.[12]

Pakistan hosted the first ever Renewable Energy Summit on August 26-27, 2019 in Islamabad in collaboration with the World Wind Association and the Global 100% RE Platform. The summit proceedings were attended by a large number of entrepreneurs engaged or interested in establishing renewable energy projects.

Alternative and Renewable Energy (ARE) Policy 2020

On August 12, 2020 Mr Omar Ayub Khan, the Federal Power Minister and the Federal Science and Technology Minister Fawad Chaudhry formally announced a new Alternative and Renewable Energy Policy prepared by the M/O Energy (Power Division) and approved by the Federal Cabinet in November 20. The new Policy is said to be based on lessons from the implementation of the 2006 ARE Policy and takes on board the global technological advances in renewable energy technologies and best practices. Extensive consultations by the Federal Government with the four provinces as well as Azad Kashmir and Gilgit Baltistan preceded the formal launching of the policy.

The new targets for renewable energy include generating 8000 MW of electricity by 2025 and 20000 by 2030 representing 20 and 30% of Pakistan's energy from renewable sources. The Power Minister mentioned that along with hydropower, by 2025 the combined share of renewable energy and hydropower in our energy stock would be 52% and reach 63% by 2030.

According to the new policy, the government will periodically announce the production targets, provide the sites, identify the type of renewable energy and invite bids by local and international investors. The cost factor will be decisive in the award of contracts.

The northern region and Khyber Pukhtunkhwa offer immense potential and multiple sites for small hydro projects of varying sizes. The plains and deserts of the central region receive ample sunshine suitable for solar power. Wind potential is largely concentrated in the Sindh and Baluchistan provinces

Minister Omar Ayub also announced the Government's resolve to actively promote domestic manufacturing of solar panels and wind turbines.

The scope of renewable sources includes solar, wind, biomass, geothermal, ocean/ tidal wave technology, energy from all kinds of waste, hydrogen or synthetic gas.[13]

According to Pakistan's Economic Survey 2019-20, the Government of Pakistan's strategic objectives of affordability of electricity, energy security, availability for all, environmental protection, sustainable development, social equity, and mitigation of climate change will further be harnessed under the new ARE Policy 20.[14]

The Economic Survey mentions that "the most significant feature of the policy is that it makes a transition from the traditional methods of procurement based on cost plus and upfront tariffs to competitive bidding". All new RE projects specifically wind and solar power projects, will be developed through competitive bidding. Under the new policy, import of all equipment, machinery and manufacturing material will be exempted from payment of duty.No income tax will be charged on the earnings of the renewable energy projects. Notably, the survey mentions that the World Bank was developing a strategy for the implementation of the new AED Policy

Ground-breaking of Mohmand Dam

On July 16, 2020 the Prime Minister launched the construction of the Diamer Basha Hydroelectric Dam on the Indus with a capacity of producing 4500 MW of electricity. The multi-purpose dam is being built with China's financial support

and has agreed to organize auctions for securing competitive bidding for renewable power generation, including localization of manufacturing technology and advanced R&D.

Overview of Renewable Energy Resources in Pakistan

Pakistan has abundant renewable energy resources which can be used for power generations. The main resources are hydropower, solar energy, wind energy, and bioenergy. The northern region and Khyber Pukhtunkhwa offer immense potential and multiple sites for small hydro projects of varying sizes. The plains and deserts of the central region receive ample sunshine suitable for solar power. Wind potential is largely concentrated in the Sindh and Balochistan provinces. The extensive farming sector in Pakistan generates large amounts of residue suitable for power generation, Pakistan has recently received generous support from the World Bank and the International Finance Corporation, the Asian Development Bank, Japan, Germany and China. The broad details of developments pertaining to the major renewable resources are noted below.

Hydropower

Hydropower is one of the oldest and cheapest resources for electricity generation projects of all sizes. In fact during the first three decades of independent Pakistan, hydropower was the only resource for producing electricity. While the majority of hydropower plants were established and are operated by the Water and Power Development Authority (WAPDA), more recently the private sector has also made significant investments in hydropower

Based on scientific investigations, the Gharo- Keti Bandar wind corridor in southern region was prioritized by the Government at the very beginning of renewable energy development in the country

The biomass feedstock available from industrial processes includes: maize husk, rice husk, corn cob and bagasse. Biomass feedstock from agricultural residue includes rice straw, sugar cane trash, wheat straw, cotton stalk and maize stock

generation. On July 16, 2020 the Prime Minister launched the construction of the Diamer Basha Hydroelectric Dam on the Indus with a capacity of producing 4500 MW of electricity. The multi-purpose dam is being built with China's financial support.

Solar Energy

The southern and south western parts of Pakistan have higher irradiation levels than the north.The highest global horizontal irradiance is in southwest Pakistan. Balochistan is the site of country's maximum annual global irradiance at just over 2300 kWh per square meter (m^2).

The solar energy sector is poised to become a major resource following the completion of 400 MW of solar PV projects in 2015-2016 and several large projects during 2017-2018 and subsequently. The Punjab, Sindh and KP provinces have issued scores of Letters of Intent for solar power generation. Pakistan has also seen a mushroom growth of enterprises for providing solar power systems to households, large farms, and small and medium size factories.

Wind Energy

The US National Renewable Energy Laboratory had created a wind map of Pakistan based on satellite data which encouraged efforts to exploit wind energy potential in Pakistan. In 2017, the World Bank – Energy Sector Management Assessment Program (ESMAP) produced more precise solar and wind atlases for Pakistan as part of their world atlases which are based on ground – level features such as wind speed measurement using wind masts of various heights at different locations.

Based on scientific investigations, the Gharo-Keti Bandar wind corridor in southern region was prioritized by the government at the very beginning of renewable energy development in the country. Consequently, the bulk of Pakistan's installed wind power is concentrated in this corridor. However, the Punjab Government's Power Development Board has identified and earmarked a location in Southern Punjab for a 1000MW wind farm. The Letter of Intent for the first project with a capacity to produce 250 MW of electricity has been issued to a Danish wind power developer.

The IFC and the Ministry of Energy have signed agreement regarding USD 500 million worth of investment for building six wind energy projects with combined capacity to produce 310 MW of electricity in the Jhimpir Corridor. This will bring wind energy projects co-financed by IFC to eleven.

Bioenergy

The third part of the World Bank-ESMAP Renewable Energy Mapping Project for Pakistan deals with bioenergy resources.The final biomass atlas, completed in 2016, has two components: theoretical biomass feedstock potential based on land use classification using satellite images and ground survey analysis, and technical feedstock potential based on ground survey results for current utilization patterns of harvest residue.

The biomass feedstock available from industrial processes includes: maize husk, rice husk, corn cob and bagasse. Biomass feedstock from

Wind Power Project Jamshoro Pakistan

The development and utilization of alternative and renewable sources of energy promotes socio- economic development and poverty eradication in the far flung regions by providing gainful employment to people, making it unnecessary to leave homes and hearths in search of jobs in cities located far from their homes

agricultural residue includes rice straw, sugar cane trash, wheat straw, cotton stalk and maize stock.

By December 2016, four sugar mills had bagasse power generation units with a combined installed capacity of 145 MW. In addition 216 MW capacity was close to completion. A number of additional sugar mills have installed power generating capacity during the recent years.[15]

Conclusions

The development and utilization of alternative and renewable sources of energy offer multiple benefits to Pakistan including the following:

- The development and deployment of the major or a large share of the country's energy supply will enable Pakistan to carry out its obligation as a responsible member of the international community to the global effort to phase out of fossil fuel-based energy, which has created the global threat of climate change. Pakistan can obtain financial and technical assistance from the multilateral windows established under the UN climate change agreements, especially the Green Climate Fund.
- Reduction in the cost of imported oil and gas. According to figures quoted by the State Bank of Pakistan, the cost of Pakistan's petroleum and gas imports has ranged between USD 17 billion (in 2016), USD 23 (in 2017) and USD 29 (in 2018). During the past five years the expenditure on imported hydrocarbons amounted to USD 22.4 billion in 2019.
- Increase in total supply of energy.
- Does not require any raw material apart from solar panels, batteries, and turbines for wind energy.
- Production of power from renewable sources does not involve use of any contaminants and does not generate any risky byproducts.
- Specially suitable for providing power to communities in the remote, mountainous and high altitude regions where extension and maintenance of grid are enormously costly.
- Promotes socio-economic development and poverty eradication in the far flung regions by providing gainful employment to people, making it unnecessary to leave homes and hearths in search of jobs in cities located far from their homes.
- The development and installation of clean energy benefits the domestic environment by reducing air pollution caused by fossil fuel-based energy; prevents waste of water that is used for all non-renewable sources of power generation.

Apart from signifying Pakistan's sincerity in contributing to the global climate action, the integration of the new Alternative and Renewable Energy Policy would secure broader support for the success of our energy policy from the international community

Recommendations

The Government should integrate the new Alternative and Renewable Energy Policy in its over all climate change policies and strategies, including its revised Nationally Determined Contribution (NDC) being finalized prior to the Climate Change Conference in 2021 in Glasgow. Apart from signifying Pakistan's sincerity in contributing to the global climate action, the integration of the new Alternative and Renewable Energy Policy would secure broader support for the success of our energy policy from the international community.

In April 2018 the International Renewable Energy Agency (IRENA) published its report captioned 'PAKISTAN: RENEWABLES READINESS ASSESSMENT' which contains the most comprehensive review of efforts made by the Government of Pakistan since 2003 to promote the development and utilization of energy produced from domestically available renewable resources. The report comprises a detailed critique of the Policy for Development of Renewable Energy adopted in 2006. The report examined the state of development of four major resources, namely, hydropower, solar energy, wind energy, and Bioenergy. It also reviews the policies and initiatives of the government for promoting clean renewable energy.

Renewable energy zoning would help in alleviating concerns about using the existing government grid for renewable energy transmission

The most useful chapter of the IRENA report is Chapter 04 captioned 'Challenges and Recommendations for Renewable Energy Deployment'.

The report recalls that in "2009 the Energy Experts Group, constituted by the Economic Advisory Council and Ministry of Finance, developed the Integrated Energy Plan 2009 – 2022 targeting 17400 MW of wind and solar power and 17392 MW of hydropower to be developed by 2022. In 2011, an integrated energy plan was developed with technical assistance from the Asian Development Bank to support the Pakistan Ministry of Planning, Development and Reform with the involvement of all relevant government agencies and ministries (International Resources Group, 2011). That plan utilized the most comprehensive and inclusive development process ever seen in Pakistan. Yet the government adopted neither of these plans as a comprehensive energy policy, and they remain indicative at best". It then proceeds to make a number of recommendations including the following.

- **Coordinate the development and implementation of an integrated energy plan:** The plan will assist policy makers in evaluating the costs and benefits of both demand and supply interventions under a given set of technological, economic, resource and environmental constraints. The process for evolving an integrated energy plan for the whole country is necessary in view of the fact that the provinces are empowered to devise their own power policies, plans and infrastructure. Those directing the process must ensure the participation of all stakeholders from the public and private sectors considering investments in power generation, transmission, distribution and energy efficiency. An integrated energy plan would help set priorities for the technology, volume and location of renewable energy projects that would make the competitive bidding process for renewable energy technologies more effective and sound.
- **Set targets for renewable energy:** Setting well–defined, realistic and time-bound targets would lend impetus for mainstreaming renewables into Pakistan's energy sector. The targets should be approved by the parliament.

Pakistan can generate 2.9 million MW clean energy from solar power

- **Encourage renewable energy zoning and competitive procurement:** Several countries, including UK, China, Brazil, and India, have benefitted enormously from organizing auctions for securing investment on the best possible terms for renewable energy projects. The Government of Pakistan has done well by signing an agreement with the World Bank for holding the auctions for competitive bidding. Renewable energy zoning would help in alleviating concerns about using the existing government grid for renewable energy transmission as underlined by the arrangements for the Quaid-e-Azam Solar Park.
- **Involve the private sector in transmission development:** The involvement of the private sector in developing and operating transmission projects allowing a proper profit for the investor would help in the government in overcoming the financial constraints of the transmission sector.
- **Develop a comprehensive distributed power generation plan:** The net-metering regulations introduced by the National Electric Power Regulatory Authority (NEPRA) provide an excellent opportunity to exploit the vastly available and geographically scattered solar energy. It is important to streamline the net metering system as well as to address the concerns of the distribution companies. The technical and financial impacts of distributed

The Federal and provincial governments should make concerted efforts to ensure that the over 50 million people living in rural areas, including some remote regions, are no longer denied access to electricity

power generation should be integrated in the overall energy planning process.

- **Pay greater attention to rural electrification:** The Federal and provincial governments should make concerted efforts to ensure that the over 50 million people living in rural areas, including some remote regions, are no longer denied access to electricity. They should consider the recommendations made by the German International Cooperation Agency (GIZ) and the Pakistan Poverty Alleviation Fund as well as enlist the National Rural Support Program (NRSP) which has carried out a number of successful initiatives for providing electricity to the rural communities in our Northern Areas and KP. They should also study the measures adopted by several South Asian and East African countries to encourage the establishment of multiple mini-grids by the private sector. Further, the government should consider the recommendations contained in the IRENA (2016) report, 'Policies and Regulations for private- sector renewable energy mini- grids'.
- **Domestic manufacturing of renewable energy equipment:** Government should consider soliciting investment for local manufacture of renewable energy equipment in order to reduce cost of production. The likely uptick in demand for equipment for renewable energy in neighboring countries as Afghanistan may create opportunities for Pakistan to export the equipment to them.
- **Provide facilities and incentives to the private start up companies**: Government to provide solar energy to the business sector and citizens. The AEDB must ensure issue of requisite permits to the private enterprises in order to encourage installation of solar energy in the country.

Amb Shafqat Kakakhel is a senior retired Pakistani diplomat who served as the UN Assistant Secretary General. He has also served as the Deputy High Commissioner in New Delhi and High Commissioner in Nairobi

NOTES

1. https://www.ipcc.ch/assessment-report/ar1/
2. https://unfccc.int/resource/docs/convkp/conveng.pdf
3. https://unfccc.int/process-and-meetings/the-kyoto-protocol/history-of-the-kyoto-protocol/text-of-the-kyoto-protocol
4. https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions
5. https://unfccc.int/sites/default/files/english_paris_agreement.pdf
6. https://unfccc.int/sites/default/files/english_paris_agreement.pdf
7. https://unfccc.int/sites/default/files/english_paris_agreement.pdf
8. https://sdgs.un.org/goals
9. https://tradingeconomics.com/pakistan/electricity-production
10. http://www.aedb.org/
11. ibid
12. https://www.pc.gov.pk/uploads/vision2025/Pakistan-Vision-2025.pdf
13. http://www.aedb.org/images/Draft_ARE_Policy_2019_-_Version_2_July_21_2019.pdf
14. http://download1.fbr.gov.pk/Docs/20206121964516543PakistanEconomicSurvey2019-20.pdf
15. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Apr/IRENA_RRA_Pakistan_2018.pdf