

ENERGY AND NATIONAL SECURITY OF PAKISTAN

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Abstract

Pakistan faces a myriad of internal and external challenges posing threats to its national security. In the modern era, all economic vistas are highly dependent on energy, hence energy security has become a vital factor that influences a state's economy, foreign policy and security policy. Pakistan has been witnessing acute energy crisis since decades and it is still hindering the economic development. Pakistan's active participation in Belt Road Initiatives has further accentuated the energy needs of Pakistan. Despite having diverse unexplored domestic energy resources, Pakistan relies heavily on foreign energy supplies which put huge burden on its fragile economy. Inadequate policy measures, global and domestic energy politics, short term planning, lack of political will and un-sustainable energy mix are major grey areas in energy security of Pakistan. This article explores the reasons of energy shortfall in Pakistan as well as requirements of energy security vis-à-vis their impact on the national security, stability and economic development of the country. In wake of the global and domestic energy politics and its multidimensional effects in the overall ambit of comprehensive security construct and the requirement of taking concrete steps to ensure energy security, have been substantiated.

Keywords: Energy Security, National Security, Economic Development, Energy Crisis, Energy Mix, Alternative Renewable Energy.

Introduction

Energy was and still remains a major concern for developed countries to sustain their economic growth, while developing states are far more affected. Quest to ensure energy security is omnipresent across the globe. Pakistan's development pace has been marred by the imbalance between demand and supply of energy, in the past few decades. For sustained technological advancement and survival, a continuous and reliable energy security is must. The world has realized that the vast and abundant natural reservoirs and deposits of energy are in no way unlimited and that we have almost depleted more than half of our oil resources by now and if it continues at same pace then the world will run out of oil in next three decades.¹

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The energy choices made by the world have ramifications for economic growth including local and global environment and even the shape of international political alliances and national defence commitments. Economic development since the beginning of industrial revolution is fuelled primarily by non-renewable mineral resources extracted from the lithosphere. The wheel of industry has been running for the last couple of centuries through the relatively abundant and low-cost energy obtained from fossil fuels with the addition of fissile fuels such as uranium in the 20th century though on a very limited scale. The other, alternative sources of energy such as biomass, wind and hydel power have been marginalized in the energy mix of the industrialized countries.²

For years, energy was considered as purely economic issue determined exclusively by market dynamics, whereas of late foreign policy analysts views it from the security perspective linked with energy politics and resource management. Pakistan, like other developing countries with growing population and corresponding increase in demand of energy is also facing energy challenges. The country is blessed with gigantic potential of untapped hydel power, vast lignite coal deposits, unexplored hydrocarbons and huge solar/wind potential for cheaper power production. However, there are multiple grey areas that are restricting utilization of these energy potentials and thus limiting self-sufficiency in energy sector. This ultimately is affecting energy security dynamics in particular and national security as a whole. This paper is aimed to evaluate existing energy security dynamics and challenges of Pakistan with its effects on national security in the overall ambit of comprehensive security construct.

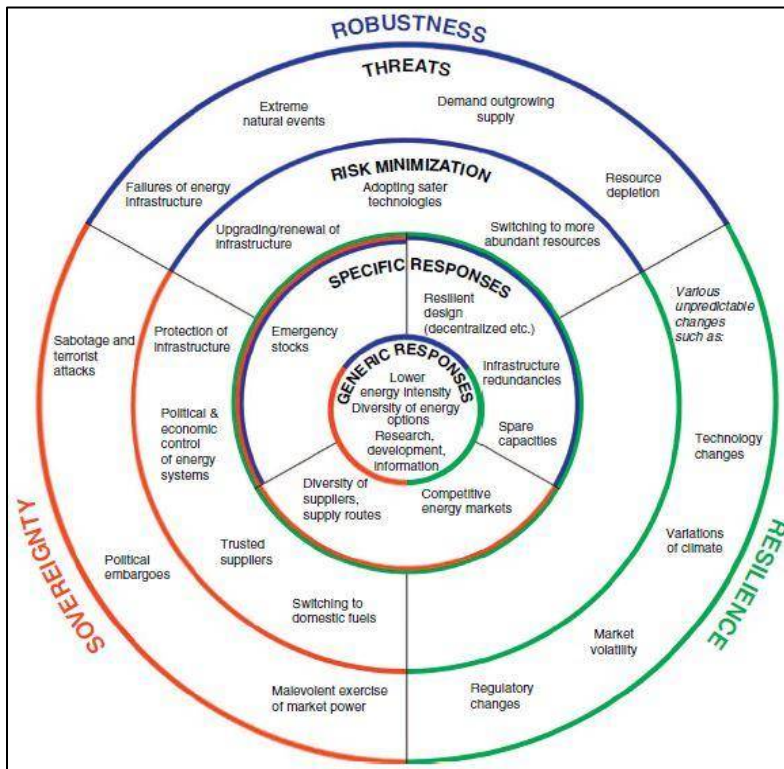
Energy Security in Theoretical Perspectives

Energy security is a vital node between economic, environmental and national security that links many sectors - economy, governance, planning, international energy markets and diplomacy. In contemporary energy-striven world, energy security is a linchpin between economic, environmental and national security. Energy security is dependent on three key elements³ of robustness, sovereignty and resilience.⁴ The Fig. 1 below explains this matrix of energy security.

The development of reliable, continuous, affordable, and environmentally sound provision of energy services combined with a focus on energy efficiency and conservation is the only way of alleviating the various multi-level dimensions of energy security. The UNDP defines energy security as *“the availability of energy at all times in various forms, in sufficient quantities and at affordable prices, without unacceptable or irreversible impact on the environment. These conditions must prevail over the long term”*.⁵ The European Commission defines the concept as *“the ability to*

ensure that future essential energy needs can be met, both by means of adequate domestic resources worked under economically acceptable conditions, or maintained as strategic reserves, and by calling upon accessible and stable external sources supplemented where appropriate by strategic stocks”.⁶

Figure-1: Matrix of Energy Security



Source: This figure is taken and cited from Aleh Cherp and Jessica Jewell, “The Three Perspectives on Energy Security: Intellectual History, Disciplinary Roots and the Potential for Integration,” *Current Opinion in Environmental Sustainability, Energy Systems*, 3, no. 4 (September 1, 2011): 207.

Conceptual Framework of Energy Security

- **Energy Security and Geo-Strategy**

Strategic assurance of uninterrupted and abundant supply of energy for world powers and their allies emerged as a key element of national interests. Limited availability of oil and gas resources around the world have forced nations to geo strategically influence their presence in regions. Modern world conflicts, if analysed

will expose the imprints of energy security. The concept of forward basing and military outposts is one good example of this concept. Nations, using military powers around the world to ensure uninterrupted, sufficient, and affordable access to energy, is thereby manifestation of this geo-strategy and there are enough proofs of its linkage with energy security.

- **Energy Security and Geo-Economics**

In the recent time, the world has moved towards an era of trade wars. Power supremacy in the world has manifestly been reflected by economic domination, which has been traditionally mainly dependent on access and control of oil-rich regions. However, the recent shift in the world's economic centre of gravity from West to East, the emerging powers are also in need of abundant energy resources to fuel their economies and industries. Therefore, access to affordable and reliable energy sources has been the focus of not only the established powers but the newly emerging economic giants are also flexing their muscles alongside the great powers to invest and develop their energy resources in Africa, Central Asia and, even in the Arctic. The golden network of pipelines, crisscrossing across the continents has become an important tool in the hand of both the emerging and established powers. Pakistan has its own relevance to the energy security of the region and beyond, especially in South Asia; both from geostrategic and geo-economic angles. In this energy scenario, Pakistan is at the centre of various regional pipeline routes; Turkmenistan, Afghanistan, Pakistan, and India (TAPI) pipeline, and Iran, Pakistan and India (IPI) Pipeline are few major examples.

- **Energy Security and National Security**

National security is the ability and freedom enjoyed by any sovereign state to make decisions without any external interference. A holistic concept of national security incorporates infinite varieties of securities i.e., human security, military as well as non-military security, economic security, environmental security, food security and of course energy security. In the 17th and 18th centuries, the Industrial Revolution in Europe and the USA required coal and other newly discovered hydrocarbons such as oil, gas and petroleum products. Therefore, European powers resorted to colonization in many parts of Africa and Asia to gain access and control over the sources of these energies and other raw material for their industries. Construction of the Suez Canal and energy pipeline projects such as 4,196km long Yamal-Europe pipeline that connects the natural gas reserves of Russia to Europe were undertaken to ensure uninterrupted supply of energy for their needs.⁷ Subsequently, a new definition of a nation's energy security emerged that encompasses continuous, affordable, sustainable, safe, reliable, and accessible availability of energy resources. Some nations prioritized safe supply and

transportation of energy in their definitions of energy security while many others gave priority to affordability and abundance in supply while self-sufficiency and self-reliance became an ideal energy posture. Production of energy depends upon multiple means; the most important feature of the energy security is to identify the elements on which to build the energy supply structure. The three main elements of energy security are: -

- Optimizing and efficiently managing the demand and supply structure of energy resources
- Increasing alternative energy share in the supply mix
- Securing long-term commitment from reliable external suppliers

Once critically analysed the aspects of geo-economics and geo-strategy and national security as mentioned above, it is evident that energy is quintessential and is wrapping up the entire gamut of comprehensive security – an area which is best understood from the lens of realism and constructivism. As realism sees the insecurity of states as the main problem in international relations and constructivists are linking it to various aspects where Energy emerges as the prime mover. Realism dictates that the states need to pursue various strategies to make themselves more secure, like hard power building, seeking alliances, economic interdependence and diplomacy. Energy again emerges out to be an important issue in today's industrialized world. Social constructivism leads nations to craft, create ideologies like One Belt One Road, Shanghai Cooperation Organization etc. to ensure the ultimate security. Pakistan, however, lacks in this sphere and this is an effort to make the readers aware of this shortcoming in the national and global context.

Energy Security Dynamics of Pakistan

Pakistan enjoys a strategic position because of its location at the crossroads of world energy resources. However, energy scenario in Pakistan is far from ideal as the country is not self-sufficient in energy resources and depends largely on imports. With the increasing energy demand and fluctuating energy prices, the import bill is continuously surging. For the last few decades, Pakistan is facing a severe energy crisis in the form of frequent power outages, increasing gas load-shedding, rising tariffs and disrupted supply of fuel. Considering energy to be a fundamental element of national security, Pakistan's current experience can best be described as energy insecurity. From the angle of geo-economics, heavy energy imports and volatility in the international market are a constant concern for the economic security of Pakistan. Pakistan has still not fully recognized energy as an integral element of security and, hence, the energy crisis has not yet received the attention it deserves as exhibited by its reliance on ad hoc measures to deal with the problem and

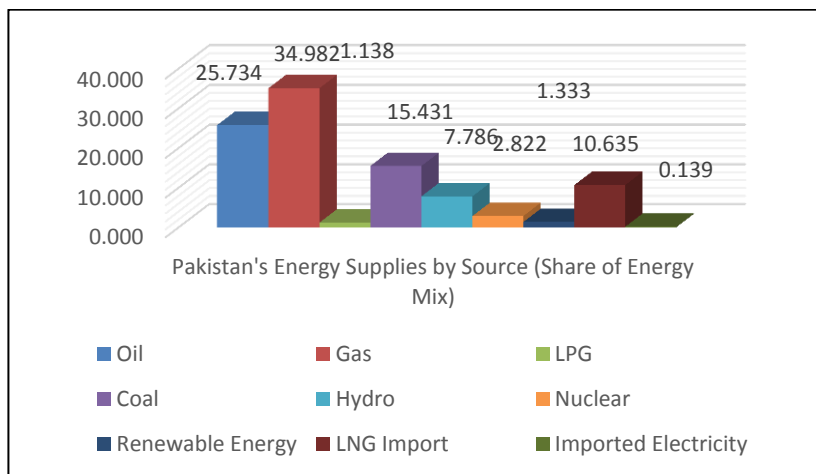
continuing with dependency on imports of oil and gas. Long-term and sustainable measures like investment in exploration of indigenous reserves, construction of hydropower projects, and focusing on alternative and renewable energy resources still wait for the sincere attention of policy makers. Consequently, energy crisis has been affecting independent foreign policy of Pakistan, as from the geopolitical perspective, energy security is critical for national sovereignty. Assurances of continuous energy supply at affordable rates from foreign suppliers are always accompanied by strings of conditions that often undermine national prestige. On the other hand, dreams for industrialization and economic self-reliance are far from realization as confidence of investors in the state has been faltering because the country has been unable to meet even the basic energy needs of its people.

Pakistan's Energy Profile

- **Primary Supplies of Energy Mix**

Pakistan's primary energy mix comprises natural gas, oil, hydropower, coal, nuclear, alternative renewable energy sources and a small percentage of imported electricity. According to latest report by NEPRA, Pakistan's primary energy supplies in the FY 2018-19, remained 83.81 million tons of oil equivalent (MTOE) with annual growth rate of -2.8%. As Fig. 2 shows that oil and gas account for the larger share of 61% in energy mix.⁸

Figure-2: Pakistan's Energy Mix (2018-19)

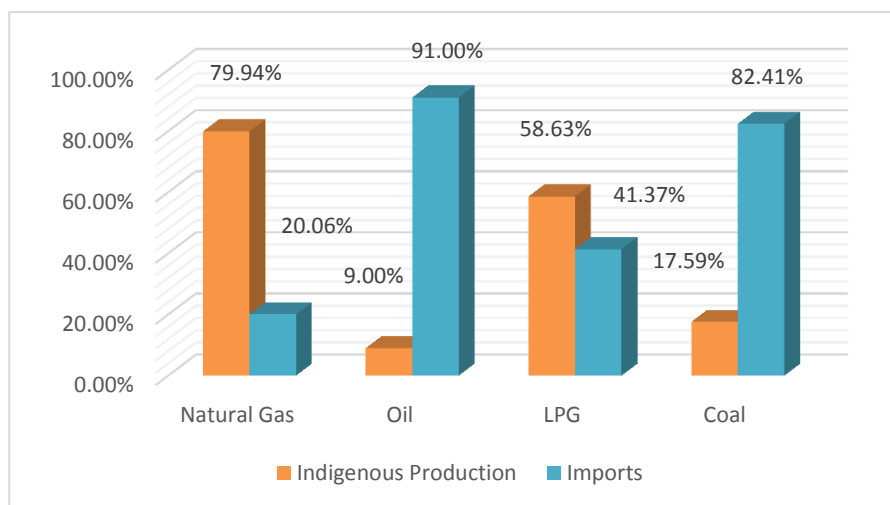


Source: Data for this graph is extracted and cited from “State of Industry,” Report (National Electric Power Regulatory Authority, 2020), 81.

- **Domestic & Imported Energy Mix**

According to latest data available, in FY of 2017-18, out of total supplies of 86 MTOE energy, Pakistan indigenously produced 46 MTOE and imported 41 MTOE which is 54% and 46% respectively. Pakistan imported 91% oil (crude & refined products) 20% gas (LNG), 82% coal and 41% LPG to meet energy requirements.⁹

Figure-3: Pakistan Domestic & Imported Energy Mix (2017-18)

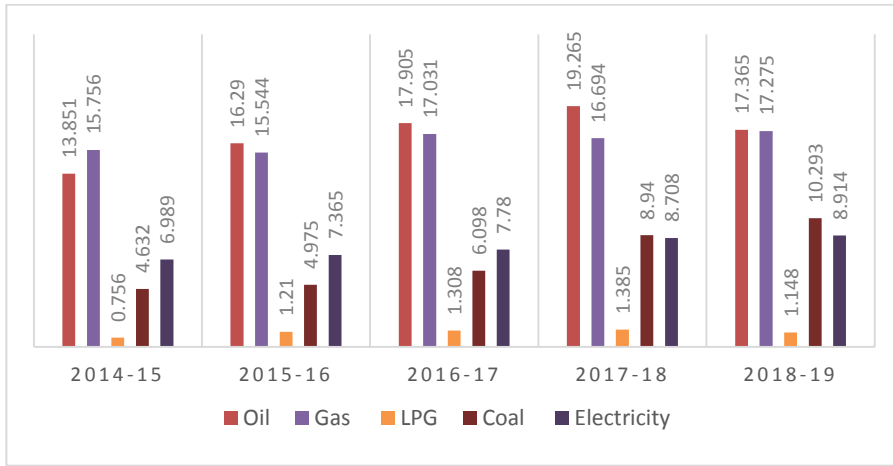


Source: Data for this graph is extracted and cited from “Pakistan Energy Yearbook,” Report (Islamabad: Hydrocarbon Development Institute of Pakistan, December 17, 2018), 4.

- **Pakistan Energy Consumption Pattern**

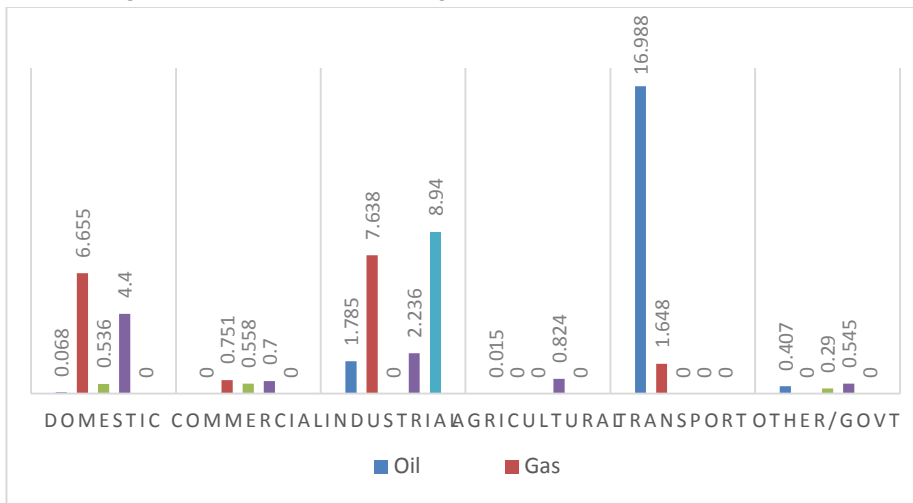
According to latest report by NEPRA, Pakistan’s total energy consumption in FY 2018-19 was 54.996 MTOE.¹⁰ Pakistan’s energy consumption is expected to grow by 70% in the next 10 years. Expected incremental power generation from indigenous Thar coal and Renewables will only cater for 15-20% of energy demand. Remaining 80-85% incremental demand to be met through imports, resulting in additional impact of USD 6-8 billion on balance of payments.¹¹ Below Fig.4 and Fig. 5 shows the Pakistan’s energy consumption by source and sector.

Figure-4: Pakistan's total Energy Consumption by Source (MTOE)



Source: Data for this graph is extracted and cited from “State of Industry,” Report (National Electric Power Regulatory Authority, 2020), 82.

Figure-5: Pakistan's total Energy Consumption by Sector (MTOE)



Source: Data for this graph is extracted and cited from “Pakistan Energy Yearbook,” Report (Islamabad: Hydrocarbon Development Institute of Pakistan, December 17, 2018), 3-8.

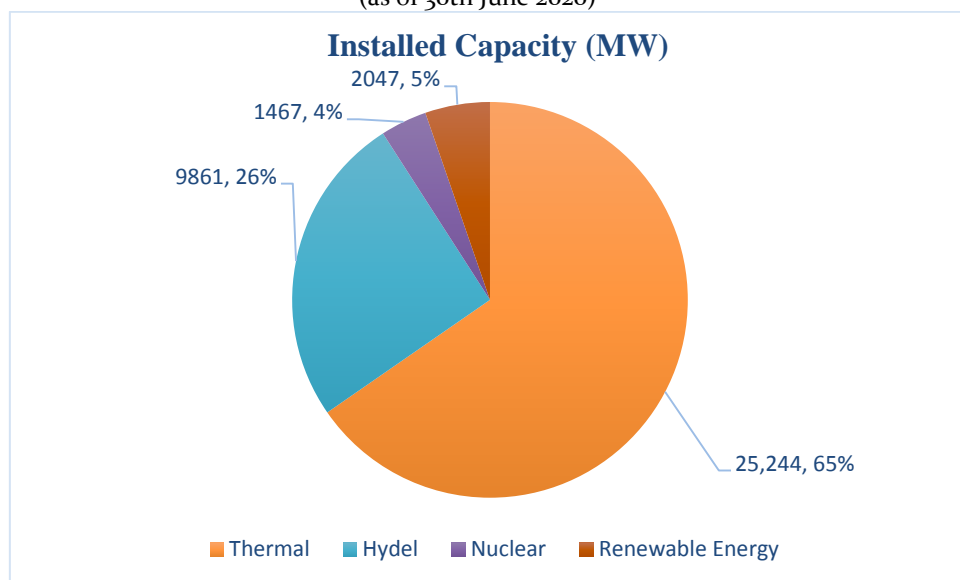
Pakistan’s Energy Resources

- **Total Installed Power Generation Capacity**

As of June 30, 2020, total installed power generation capacity in Pakistan stands at 38,719 MW, of which 35,735 MW is connected with NTDC system whereas

2,984 MW is connected with K-Electric Limited (KEL) system.¹² The distribution of installed capacity by source is shown in Fig. 10 below.

Figure-6: Pakistan's Total Installed Power Generation Capacity (as of 30th June 2020)



Source: Data for this graph is extracted and cited from “State of Industry,” Report (National Electric Power Regulatory Authority, 2020), 88.

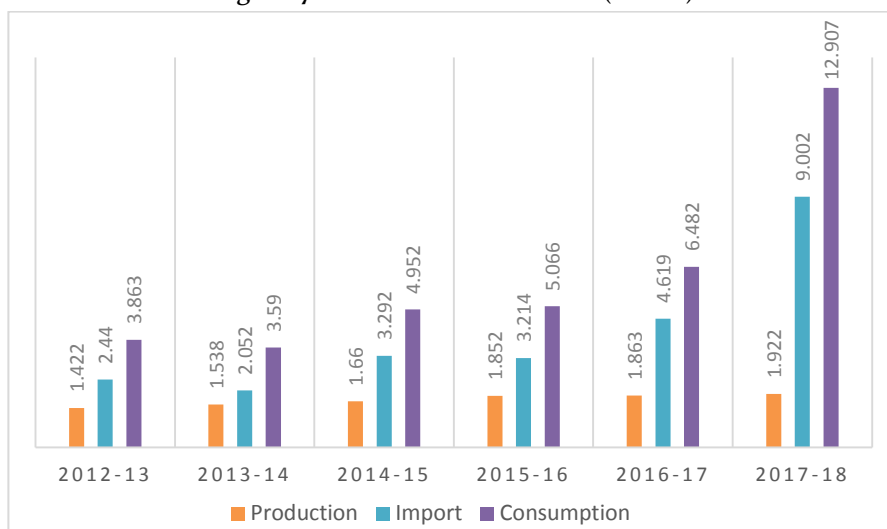
• Oil and Gas

Oil and gas are the main energy sources of Pakistan. According to latest report, in FY 2018-19, a combined energy supply of crude oil, refined petroleum products, LNG, LPG, and natural gas accounts for 76 percent of the energy supply, of which 25.7 percent is of oil, 45.6 percent is of gas including LNG and 1.1 percent is of LPG (Fig.2). Bulk of this, is imported as indigenous exploration and production is still underdeveloped despite huge potential.¹³ As per FY-2018 estimates, the Annual Compound Growth Rate (ACGR) of gas and oil in Pakistan was only 5.1 percent while the production of natural gas saw a decline of 0.8 percent in the same period.¹⁴ In total, Pakistan has 254 oil fields, 70 associated and 240 non-associated gas fields. However, most of these are small and are depleting. The Sui field, which accounts for 25 percent of the supply, is on the decline. The shortfall in gas is expected to reach 6,611 Bcf/D by FY 2029-30.¹⁵ In contrast, consumption is continuously rising. This gap between demand and indigenous supply is going to deepen further as local gas reserves are fast depleting while consumption is on the increase.

- **Coal**

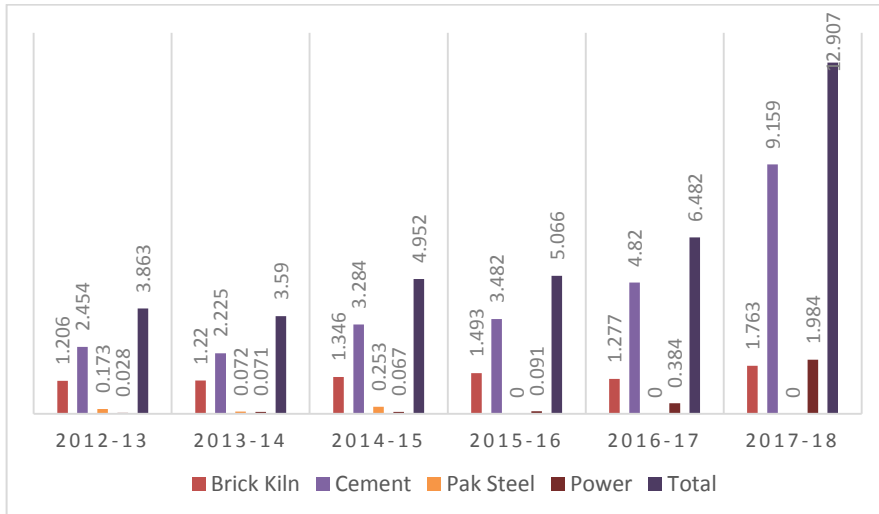
Pakistan is a coal-rich country, with total 7775.5 million tonnes of measured reserves. Out of measured reserves, it is currently producing 4.3 million tonnes of coal. The average consumption is almost 17.9 million tonnes.¹⁶ This huge potential has not been harvested for decades due to insufficient financing, underdeveloped infrastructure and lack of modern technical expertise. However, there are other more serious concerns as well; the quality of coal especially in the Thar is not very economical for power production. In addition, the environmental pollution that it is going to cost will further deteriorate the already threatened safety levels as coal pollutes the environment like no other fuel does. The Fig.6 shows the year wise statistics of coal production, consumption and import.

Figure-7: Coal Statistics Year Wise (MTOE)



Source: Data for this graph is extracted and cited from “Pakistan Energy Yearbook,” Report (Islamabad: Hydrocarbon Development Institute of Pakistan, December 17, 2018), 83-84.

Figure-8: Coal Consumption Sector Wise (MTOE)

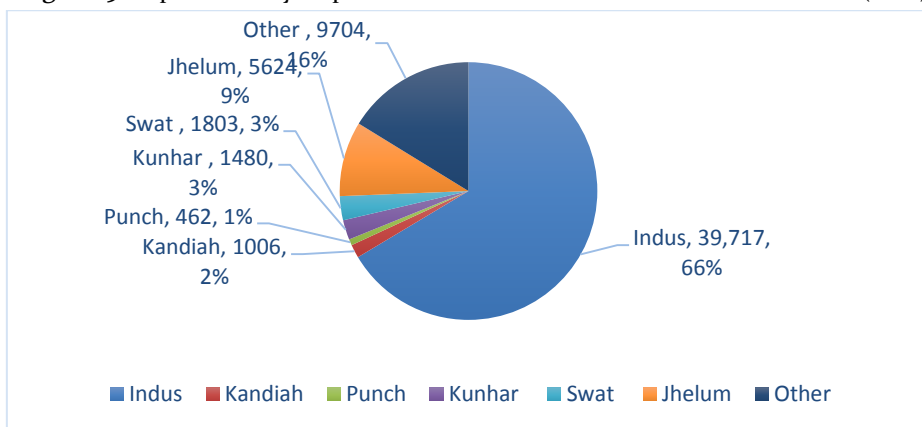


Source: Data for this graph is extracted and cited from “Pakistan Energy Yearbook,” Report (Islamabad: Hydrocarbon Development Institute of Pakistan, December 17, 2018), 84.

• **Hydropower**

Hydropower has traditionally been the prominent source of energy in Pakistan. Pakistan has total of 60,000 MW (approx.) of hydropower potential.¹⁷ Distribution of this exploitable potential of different water resources in Pakistan¹⁸ is given below in Fig. 8.

Figure-9: Exploitable Hydropower Potential of Water Resources in Pakistan (MW)



Source: Data for this graph is extracted and cited from “Hydropower Resources of Pakistan,” Report (Islamabad, Pakistan: Private Power and Infrastructure Board, Ministry of Water and Power, Government of Pakistan, February 2011), 12.

As of June 2020, Pakistan has been able to exploit only 11 percent of total hydropower potential so far. Pakistan has total 9,861 MW of hydropower generation installed capacity which is connected with Pakistan Electric Power Company (PEPCO) / National Transmission & Despatch Company (NTDC) system, developed by Water and Power Development Authority (WAPDA) and Independent Power Producers (IPPs).¹⁹ Currently, hydropower is contributing around 25 percent to total installed power generation capacity in the country. However, the existing installed capacity remains far below the country's economically and technically viable potential, including the significant potential for development of small-scale run-of-river hydropower projects. The share of hydel & thermal power generation was 65% to 35% during the years 1960-70 which has almost gone reverse in the power system due to non-construction of any mega hydel project.

The imbalance between hydel and thermal has increased the demand of imported fuels and severely affecting Country Foreign Exchange of the available potential resources. The high tariff rates of IPPs are consuming major share of revenue and have also caused immense increase in overall electricity tariff rates.²⁰ The construction of hydropower projects remain neglected due to lack of political will and politicization of different hydropower projects. Controversy over Kalabagh dam halted development on other hydropower projects as well. Presently, as table 1 shows, around 30,428.07 MW (approx.)²¹ of hydropower projects are at different stages of development under the China Pakistan Economic Corridor (CPEC) and non CPEC domains that are likely to be completed by 2025-30.

Table-1: Under Development Hydropower Capacity

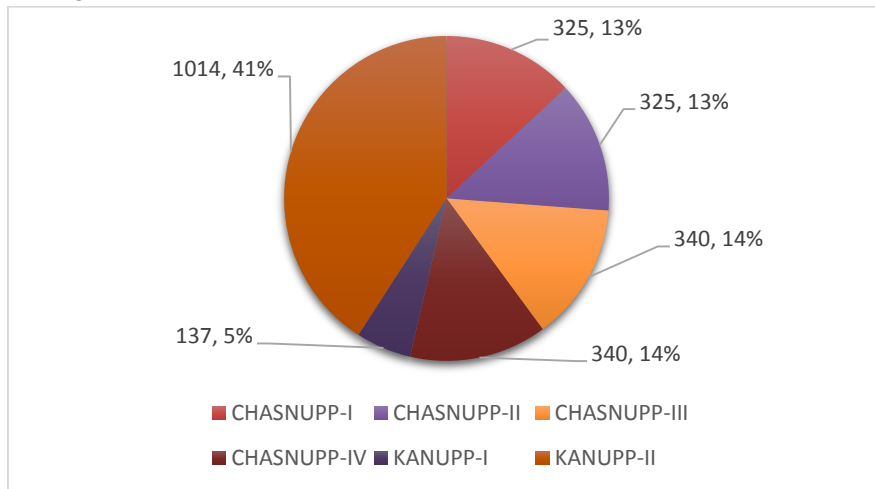
Sr. No.	Project Name	Power Generation Capacity (MW)
Hydro Power (Under Construction)		
1.	Dasu	4,320
2.	Keyal Khwar	128
3.	Kurram Tangi	83.4
Sub Total (A)		4,531.4
Hydro Power (Ready For Construction)		
1.	Bunji	7,100
2.	Harpo	34.5
3.	Mohmand Dam	800
4.	Tarbela 5th Extension	1,410
Sub Total (B)		9,344.5
Hydro Power (Future)		
1.	Basho Hydropower Project	40

2.	Chitral Power Enhancement	5
3.	Dudhnial Dam Multipurpose Project	960
4.	Hingol Dam Project	1.37
5.	Lower Palas Valley	665
6.	Lower Spat Gah	496
7.	Middle Palas Valley Hydro Power Project	398
8.	Middle Spat Gah Hydro Power Project	489
9.	Murunj Dam Project	12
10.	Patan	2,400
11.	Phandar Hydro Power Project	80
12.	Renala Power Rehabilitation	4.4
13.	Shyok Dam Multipurpose Project	640
14.	Tank Zam Dam Project	25.4
15.	Thakot Hydro Power Project	4,927
16.	Tungas Hydro Power Project	2,200
17.	Upper Palas Valley Hydro Power Project	157
18.	Upper Spat Gah Hydro Power Project	252
19.	Yulbo Hydro Power Project	2,800
Sub Total (C)		16,552.17
Total Hydropower Capacity (MW) = Sub Total A+B+C		30, 428.07

Source: Data for this table is extracted and cited from “Hydropower Projects,” Pakistan Water and Power Development Authority (WAPDA), May 15, 2021, <http://www.wapda.gov.pk/index.php/projects/hydro-power/under-construction/warsak-power-rehabilitation/itemlist/category/35-under-construction>.

• **Nuclear Power**

Nuclear power is competitive compared to other electricity generation options, but requires high initial investments, huge industrial infrastructure and sophisticated technical expertise for its development and operation. Pakistan started developing nuclear energy in 1960s and currently producing 1,467 MW plus 1,014 MW from Karachi Nuclear Power Plant-II (KANUPP-II) making total of 2,481 MW of nuclear energy; contributing around 6 percent to total installed power generation capacity in the country.²² Karachi Nuclear Power Plant - III (KANUPP-III) with capacity of 1,014 MW is under construction and will be operational in 2022.²³ However, Pakistan is targeting 8,800 MW of tangible nuclear power generation capacity by 2030.²⁴ The Fig. 9 below shows the current installed capacity of nuclear power plants in Pakistan.

Figure-10: Installed Capacity of Nuclear Power Plants in Pakistan (MW)

Source: Data for this graph is extracted and cited from “State of Industry,” Report (National Electric Power Regulatory Authority, 2020), 86.

Challenges to Pakistan’s Energy Security – An Overview

Pakistan is faced with a energy crisis that is jeopardizing the economy and impeding efforts towards sustainable development. The present energy crisis in Pakistan is the outcome of what may be termed as bad governance and mismanagement on the part of policymakers, operators, and regulators in the country. Short-term solutions have been pursued to deal with the challenge instead of any long-term planning and consistent efforts to cope with the issue. Most disturbing trends in the Pakistan energy sector are:-

- State policies in the recent years have resulted in creating a surplus power generation capacity in Pakistan to ensure power supply availability for the medium term. Obsolete and defective transmission & distribution system is a huge impediment in energy development in Pakistan.
- Pakistan has increased its dependence on oil over the last decade, which is constituting one-fourth of country’s import bill.
- For long, there has been no major investment in developing hydel power generation, despite its reputation of being the most economical and sustainable source of energy supply. Hydropower generation has declined to 25 % from 35 to 65 % in 1960s.
- The share of alternative and renewable energy sources like solar and wind remains modest in the energy supply mix, lesser than 2%²⁵ as per

latest estimates, despite having a very high potential for renewable and climate-friendly energy.

- Pakistan's limited gas reserves have considerably depleted due to high reliance over them. At the same time, there is a lack of attention on new discoveries through exploration.
- To fill the supply-demand gap, the government resorted to the importation of LNG a few years back but being a higher cost option.

Major Causes of Energy Crisis in Pakistan

- ***Governance Structure***

Currently there are numerous agencies working under two different ministries for energy development, transmission and regulation with their own terms of reference, policies and strategies without any efficient system of coordination. Since June 2017, two regulatory authorities have been put under control of two different ministries i.e., NEPRA under Water and Power Division and Oil and Gas Regulation Authority (OGRA) under Petroleum and Natural Resource Division. These regulatory authorities are working in highly centralized manner under considerable political influence on pricing and tariffs.

- ***Policy Issues***

Absence of an energy policy to provide guidance for improved monitoring, evaluation, and decision making by the government for the secure supply of energy accentuates lack of integration in energy policymaking and implementation as there are separate bodies for policy making, planning, developing a legal and regulatory framework for each fuel mix.

- ***Barriers for Hydropower Projects***

Over the years, a strong inclination has been observed towards promoting Independent Power Plant's and generation through thermal sources, while ignoring the hydel sector resulting in fall in the ratio of hydel energy in the overall energy mix. In the past three decades our policies has been focusing more on short term quick solutions.

- ***Heavy Reliance on Imported Fossil Fuel***

Heavy reliance on imported fossil fuels particularly oil and LNG has been the trend in our energy profile. Oil and LNG worth \$824.872 million²⁶ were imported in FY 2020-21 which is nearly 15% of the entire import bill.²⁷

- ***Depletion of Indigenous Gas***

Share of indigenous natural gas has reduced from 43% of energy mix in 2014 to 34% in 2019 as Pakistan's depleting reserves are sufficient only to sustain current levels of gas consumption of (17.2 MTOE) for the next only 25 years.²⁸ Indigenous supplies are expected to decline by approximately 50% in the next 10 years, which will have to be covered through LNG imports in addition to catering for incremental demand growth.

- ***Shale Gas Exploration***

According to a report published by US Energy Information Administration (EIA), Pakistan has estimated fresh recoverable shale gas reserves of 105 trillion cubic feet (Tcf) and more than nine billion barrels of oil in Pakistan.²⁹ Shale gas had seen tremendous developments in a couple of other countries.

- ***Independent Power Producers (IPPs) Issue***

Introduction of IPPs in energy sector had considerable implications on power sector that raised the prices of power and shifted Pakistan energy mix in favour of oil and gas. In addition, the inexpedient agreements with IPPs allowing them to set high tariffs and inessential guarantees also aided to the power crisis in Pakistan.

- ***Transmission and Distribution Losses***

Pakistan ranks 14 out of 131 countries of world in T&D losses. T&D loss of one percent can incur deficit of approximately twenty billion rupees over national treasury.³⁰ These T&D losses are both technical and non- technical/commercial, both arising mainly due to poor administration and poor governance.

- ***Fuel Storage Capacity***

Pakistan is importing 80% of crude and refined oil products through 17 Oil Marketing Companies (OMCs) which have to maintain 21 days stocks but most of the time their stocks are not more than 10 to 13 days due to financial constraints & lack of storage infrastructure. Even 21 days stocking level is not enough as Pakistan is highly dependent on oil from Middle East which is a volatile region and crisis in the ME can make country's supply chain further vulnerable. Moreover, due to unpredictable international oil prices, Pakistan keeps suffering from oil price shocks.

- ***Issues in Oil Refining Sector***

Currently, there are five major oil refineries in Pakistan whose combined

capacity is about 417,400 barrel per day (BPD).³¹ In Pakistan all the refineries are of old hydro skimming technology, which produces 30 to 40 % furnace oil and low standard fuels. Converting these refineries from hydro skimming to deep conversion is need of time apart from increasing refining capacity.

- ***Indigenous Sources of Energy***

Pakistan is an energy deficient country despite having sufficient natural resources and potential. Coal is still used as a major source of power generation in world and Pakistan has huge untapped coal reserves. Furthermore, the renewable power generation potential of Pakistan is also enough for satisfying the energy demands.

- ***Offshore Hydrocarbon Exploration***

Pakistan has huge potential of hydrocarbons in its offshore area. Though drilling done in Kekra-1 block³² was not successful but still there is a good potential of hydrocarbons production in Pakistan offshore area.

- ***Inappropriate Energy Mix and Share of Alternative Renewable Energy Resources***

There is a high reliance on expensive imported oil with very less power generation from coal despite huge potential to generate 4000 MW of electricity by utilizing only 1% of total Thar coal reserves alone.³³ Alternative energy resources including solar, wind and biogas options are ignored too.

- ***Circular Debt***

Government policies, failure to recover T&D losses, overstaffing, delays in payments, inefficiency in collection of revenue, and inappropriate allocation of subsidies are issues of paramount importance that are responsible for lingered circular debt in country.

- ***Undue Subsidies***

The imbalance between electricity price per unit and per unit cost of supply is covered through subsidy. Despite paying heavy subsidies for helping the poor households, the major portion of these subsidies benefit richest households in country.

- ***Lack of Financial Resources***

Availability of technical, financial or human resources is crucial for the

success of any policy or project. Lack of financial resource is also responsible for poor infrastructural development and inability to solve the circular debt issue of Pakistan.

- ***Non-Development of Human Resource***

Inadequate focus on development of human resource has created lack of skilled manpower in energy sector. Resultantly, inefficient and irrelevant persons at crucial positions have deteriorated the sector performance. The short-term solutions were adopted by highly paid consulting foreign agencies and experts causing further stress on national treasury.

Way Forward

Pakistan despite its relevance to the energy security of the region and beyond, has not been able to solve this crisis due to different roles and policies of the multiple energy bodies and organizations in the country. *The current situation demands strict implementation of the following steps to achieve energy security in Pakistan.*

- ***Improving Energy Governance by Establishment of National Energy Authority***

There is a need to establish a single National Energy Authority (NEA) to oversee all institutions in the energy sector. NEA must have the power to coordinate the efforts of all the sectors, relating to drafting and implementation of a single energy policy.

- ***Energy Security Policy***

Pakistan has to come up with a clear long-term, consistent, and rationale policy for the energy security of Pakistan; therefore, a centralized comprehensive policy to address existing energy sector issues, is required to be formulated. There are following recommended key policy goals.

- Realistic and Objective Oriented Approach in Formulating Policy. Policy making should be realistic based on actual potential and affordability. Tendency to make false promises by political parties be curbed. Objectives and goals of policy should be attainable and practicable.
- Achieving Robustness, Resilience and Sovereignty. Main policy goal for ensuring the energy security of Pakistan should concentrate on robustness, resilience and upholding sovereignty focusing on reduction in imports and more reliance on exploiting local resources.
- Ensuring Efficient Energy Consumption Policy. To reduce the demand

and supply gap, the policy is to focus on both increasing supply and decreasing consumption by minimizing distribution losses and other wastages.

- ***Formulation of Integrated Energy Policy***

Integrated energy planning is to be followed with four key considerations.

- Minimize Burden on Balance of Payments. Indigenization is to be pursued ensuring national energy security. For instance, Thar coal may also be explored for its potential of conversion into other energy forms for use in other industries.
- Maximize Storage Based Hydro Projects. Under-development Hydropower projects should be completed without any further delay. Other multiple projects with over 25,000 MW that are at feasibility / engineering stage with WAPDA should be expedited.
- Exploit Solar/Wind Potential. Best use of solar is at small scale domestic application whereas wind potential should be harnessed through large scale wind farms. Local solar assembling and manufacturing industries need to be encouraged and developed.
- Exploit Local Hydrocarbon Resources. Adequate incentives should be provided in the policy framework for expeditious development of shale gas/oil potential. Unexplored areas where 3D seismic surveys have been completed must be opened for gas and oil exploration.

- ***Ensure Competitive Tariffs***

- Natural Gas Tariff. Captive power plants receive selective advantage in terms of gas allocation and pricing. In current power surplus situation, captive power plants must move to national grid. Gas pricing to captive power plants must also ensure levelized cost of power generation at par with new RLNG based power plants.
- Power Sector Tariff. Reduction in T&D losses from 20% to 10% in the next 5 years can reduce the consumer tariffs by around 1-1.5 cents/kwh. DISCOs should be allowed recovery of capital investment for investment in replacement/upgradation of technology required for reducing T&D losses.

- ***Energy Efficiency and Conservation***

- Hybrid / Electric Vehicles. Hybrid & electrical vehicles should be promoted/incentivized in the new Auto Policy including installation of battery charging stations.

- LED Lightening. LED bulbs are approximately 50-80% more efficient than other alternates. Import duties and sales tax on LED bulbs should be removed and industry be incentivized for local manufacturing.
- Building Codes and Commercial Shopping Centers. There is a need of creating awareness about energy conservation and using day light hours. Pakistan can save up to 1,100 megawatts of energy if its industries and households – the two main energy consuming sectors try to change their behaviour about energy conservation.
- **Revising Independent Power Producers (IPPs) System**
 - Energy efficiency Tests of IPPs. In order to analyze efficiency of installed IPPs, energy efficiency tests of every IPP be conducted at priority. IPPs to enhance their production and those with less efficiency may be decommissioned.
- **Building a Balanced / Diversified Energy Supply Mix**

The desirable energy supply mix can generate a gross installed capacity of 118,268 MW of power by the year 2030 in which indigenous energy resources of Pakistan as a whole represent 80.7 percent. The share of oil and gas in the supply structure is to be reduced to only 11.8 percent with the total gross installed capacity less than 14000 MW.

 - Increased Alternative Renewable Energy Share in the Supply Mix. A diversified approach is needed to be adopted with increase in the share of solar, wind, biomass, and nuclear resources of energy. Wind Projects planned in already identified wind corridors of Sind and Baluchistan be completed.
 - Enhanced Use of Nuclear Energy. A self-sustaining Nuclear Power Vision 2050 for producing 40,000 MW is to be earnestly perused.
 - Solar Sector in Energy Production through Net Metering. The potential of solar energy is high in Pakistan. Utility companies should be tasked to propagate 'net metering' for domestic consumers, to generates low-cost electricity during daytime, when power demand maximizes.
- **Development of Inter Provincial – Federal Harmony on Energy Issues**

The grievances of provinces on water share, hydroelectric profit, share of energy and other energy related issues should be addressed. Myths related to disputed large reservoirs be exploded and political rifts and issues should be delinked from such important energy projects by building confidence and bringing provinces together through just distribution of resources and awareness campaigns.

- ***Strong and Continued Political Will***

Strong and continued political will for structural reforms is needed in order to secure the future energy needs. Political consensus on the issues of energy tariffs, T&D losses and recovery of energy costs should be developed with a view to curb financial deficits in energy supply chain.

- ***Promotion of Biogas in Ruler Areas for Domestic Use***

Pakistan is the 13th largest country in cattle production and can produce biogas for off grid uses in villages and small towns to reduce the dependence on gas for domestic use.

- ***Waste to Energy Projects***

The solid waste in 9 major urban centers is around 7.12 million tons per annum which is increasing by 2.5 % per year. This capacity can be utilized to produce power generation of around 13,900 GWh per annum.

- ***Use of Modern Technologies***

Recently, Pakistan faced a countrywide blackout due to sudden decrease in frequency in transmission system.³⁴ Pakistan still operates outdated power grids and transmission systems. There is a need to utilize the latest technologies in the energy sector i.e., automation, efficient management, fault eradication, Artificial Intelligence, smart computers, latest research and development tools to avoid undesired power cuts and T&D losses.

Conclusion and Policy Implications

To meet the growing demand of Pakistan's energy, country needs a multi-pronged approach and all-encompassing energy eco-system, comprising of a strategic energy culture, a national energy narrative, a national social energy outlook, and energy supportive education to develop human capital system and also a system of incentivizing the energy sector. Energy security can be achieved through political will, robustness and resilience. Pakistan needs to have the right methodology and structure to go about the energy security. Also needs to have the right energy mix and reduced dependence on fossil fuels. There is a dire need to exploit indigenous resources whether they are hydel, renewable, nuclear or coal to bring energy sufficiency and reduce the cost of imported energy. The over utilization of expensive imported resources has already deteriorated the energy situation and has seriously impacted our economy. The diversification of the energy mix and utilization of indigenous resources is key option with Pakistan to ensure its energy security. At the same time, environmental concerns should be kept at the forefront in dealing with

the energy crisis and options for greener and sustainable energy should get the priority in order to ensure a cleaner environment for the local population.

References

- ¹ "World Energy Resources," Report (World Energy Council, 2016), 40–42, <https://www.worldenergy.org/assets/images/imported/2016/10/World-Energy-Resources-Full-report-2016.10.03.pdf>.
- ² Jean-Marie Chevalier, *The Great Energy Battles: A Small Treatise on a Violent Economy* (Paris: Paris Dauphine University, 2004).
- ³ Aleh Cherp and Jessica Jewell, "The Three Perspectives on Energy Security: Intellectual History, Disciplinary Roots and the Potential for Integration," *Current Opinion in Environmental Sustainability*, Energy Systems, 3, no. 4 (September 1, 2011): 207, <https://doi.org/10.1016/j.cosust.2011.07.001>.
- ⁴ Three perspectives on energy security have their roots in separate academic disciplines: political science (the sovereignty perspective), natural science and engineering (the robustness perspective) and economics (the resilience perspectives). They differ with respect to their focus on different energy security threats and response strategies. The 'no-regrets' responses situated in the center of the diagram address the concerns of all three perspectives.
- ⁵ "World Energy Assessment," Report (New York, USA: United Nations Development Programme, 2004), 44.
- ⁶ Saman Zulfqar, "Pakistan's Energy Security: Viability of Regional Options," *Journal of Current Affairs* 2, no. 2 (2018): 44; "Global Energy Security Defined," DAWN, June 17, 2012, <https://www.dawn.com/2012/06/17/global-energy-security-defined/>.
- ⁷ "Yamal–Europe Pipeline," in *Wikipedia*, January 21, 2021, https://en.wikipedia.org/w/index.php?title=Yamal%E2%80%99s_Europe_pipeline&oldid=1001808239.
- ⁸ "State of Industry," Report (National Electric Power Regulatory Authority, 2020), 81.
- ⁹ "Pakistan Energy Yearbook," Report (Islamabad: Hydrocarbon Development Institute of Pakistan, December 17, 2018), 4.
- ¹⁰ "State of Industry," 82.
- ¹¹ "Pakistan Energy Yearbook," 3–8.
- ¹² "State of Industry," 88.
- ¹³ "State of Industry," 81.
- ¹⁴ "Pakistan Energy Yearbook," 3.
- ¹⁵ "Pakistan Energy Yearbook," 11–54.
- ¹⁶ "Pakistan Energy Yearbook," 80.
- ¹⁷ "WAPDA Annual Report 2018–19," Annual Report (Lahore, Pakistan: Water and Power Development Authority, June 30, 2019), 71.
- ¹⁸ "Hydropower Resources of Pakistan," Report (Islamabad, Pakistan: Private Power and Infrastructure Board, Ministry of Water and Power, Government of Pakistan, February 2011), 12, https://www.ppib.gov.pk/publications/hydel_resources.pdf.
- ¹⁹ "State of Industry," 85.
- ²⁰ "WAPDA Annual Report 2018–19," 71–72.
- ²¹ "Hydropower Projects," Pakistan Water and Power Development Authority (WAPDA), May 15, 2021, <http://www.wapda.gov.pk/index.php/projects/hydro-power/under-construction/warsak-power-rehabilitation/itemlist/category/35-under-construction>.
- ²² "State of Industry," 84; "PM to Virtually Inaugurate KANUPP-2 Today," *The Express Tribune*, May 21, 2021, <http://tribune.com.pk/story/2300897/pm-to-virtually-inaugurate-kanupp-2-today>.
- ²³ "PM to Virtually Inaugurate KANUPP-2 Today."
- ²⁴ "Nuclear Power Profile of Pakistan," International Atomic Energy Agency (IAEA), December 2020, <https://cnpp.iaea.org/countryprofiles/Pakistan/Pakistan.htm>.
- ²⁵ "State of Industry," 81.
- ²⁶ "Oil Import," *The News*, January 24, 2021, <https://www.thenews.com.pk/print/778910-oil-import>.
- ²⁷ "Pakistan Total Imports 1996 – 2021," CEIC, April 2021, <https://www.ceicdata.com/en/indicator/pakistan/total-imports>.
- ²⁸ "State of Industry," 81–82.
- ²⁹ "Pakistan Energy Data," US Energy Information Administration, August 2016, <https://www.eia.gov/international/analysis/country/PAK>.
- ³⁰ Shahzad Sarwar Bhatti, Umair Umer Lodhi, and Shan ul Haq, "Electric Power Transmission and Distribution Losses Overview and Minimization in Pakistan," *International Journal of Scientific & Engineering Research* 6, no. 4 (April 2015): 110.
- ³¹ "5 Refineries with 417,400 BPD Oil Installed Capacity Operating in Pakistan," *The Nation*, June 18, 2020, <https://nation.com.pk/18-Jun-2020/5-refineries-with-417-400-bpd-oil-installed-capacity-operating-in-pakistan>.
- ³² "Hopes Fade as No Oil, Gas Reservoir Found in Kekra-1," *The News*, May 18, 2019, <https://www.thenews.com.pk/latest/473016-kekra-1-well-in-deep-sea-no-reservoir-found-drilling-halted>.
- ³³ "Towards Pakistan's Energy Security and Competitiveness," Report (Pakistan Business Council, 2019), 58, <https://www.pbc.org.pk/wp-content/uploads/Towards-Pakistan2019s-Energy-Security-and-Competitiveness.pdf>.
- ³⁴ "Pakistan Power Cut Plunges Country into Darkness," *BBC News*, January 10, 2021, sec. Asia, <https://www.bbc.com/news/world-asia-55606598>.