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Theoretical Analysis of Hydro Power in Afghanistan: Future Potential and Current Status of Hydro Power

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Abstract - *Renewable Energy is the best substitution for the conventional usage of energy in form of burning of Fossil Fuel. Afghanistan has very serious problems in energy supply system, decades of war is one of the main reasons behind the undeveloped supply system in the country. The conventional system of supply is not capable for sustainable economic growth and the country is still struggling to access to energy in sustainable platform. Very less percentage of the whole population is accessed to electricity which depending on importing electricity from neighboring countries.*

Key Words: **Hydro Power, Reliable Energy resources, Imported Electricity, Afghanistan Energy Sector**

1. INTRODUCTION

For nearly three decades of conflict in the country the energy sector in Afghanistan was significantly disrupted by war. Hereof, Afghanistan's power generation, transmission, and distribution infrastructure has destroyed, the demand and supply are not in balance, even the supply is far away from the demand. [1] The access to electricity was so limited almost 90% of the total population was not accessed to electricity. In January 2009, the electricity came to Kabul under the new constructed transmission line running from neighboring country Uzbekistan. After decades of war in the country for the first-time majority of the capital's 4 million people could enjoy the benefit of electricity. [2]

Afghanistan electricity sector has been managed together by Ministry of Energy and Water (MEW) and Da Afghanistan Breshna Sherkat (DABS). Where, MEW's responsibilities include water and energy which are the two main factors in the country economic development sector. According to Afghanistan National Development Strategy (ANDS) the ministry id more responsible in water and electricity related issues mainly development of policies and plans for energy sectors, new infrastructural projects planning, procurement and implementation, bilateral energy import and export agreements, transmission projects. DABS is a national electricity company. Da Afghanistan Breshna Sherkat was established as an independent corporation for a better management. an independent and autonomous company established under the corporations and limited accountabilities law of the Islamic Republic of Afghanistan. Da Moassessa Breshna Replaced by DABS on the 4th May 2008. DABS main Responsibilities are managing of electric power generation, import of electricity, transmission and distribution throughout Afghanistan on a commercial basis. DABS has different shareholders which are namely (Ministry of Finance 45%, Ministry of Energy and Water 35%, Ministry of Economy 10% and Ministry of Urban Development and Housing 10%). DABS are aiming to provide electricity with economical rate to help country's economic growth with integrity. [3]

In September 2008 Afghanistan signed a new contract for 20 years. The agreement was signed between Tajikistan power (Barki Tajik) and DABS. Under this contract Afghanistan could import 500 GWh electricity annually from the neighboring country Tajikistan during summer season. After 5 years, Based on both country's cooperation. new contract will be signed upon based on Tajikistan's export surplus and Afghanistan's demand. Construction contracts have been awarded in both countries and project commissioning is scheduled for the second half of 2010. [4]

Table 1

The total production and imported power in Afghanistan. [4]

Current Sources of power

SI NO	Source of Power	Share in MW
1	Fossil Fuels (Diesel & Gas)	10%
2	Hydro Power	8%
3	Renewable Energy	2%
4	Imports Power	80%
Total		100%

After security the first priority is access to energy (fig 2). Afghanistan is genuine importer of electricity from neighboring countries. In 2014 more than 80% of energy supply depended on importing electricity from neighboring countries Iran, Tajikistan, Turkmenistan, and Uzbekistan and the rest of energy supply depended on indigenous hydropower and other thermal sources. Lack of domestic energy generation is still a biggest challenge in energy sector for the country.

Literature Review

Mahdi Sadiqi, Anil Pahwa, introduced Hydro power as capable resource for generating of electricity in Afghanistan. Their study under the title of "Basic Design and Cost Optimization of hydropower system for rural communities in Afghanistan" expressed, the country has good potential of hydro power especially in remote rural areas, implementation of micro-hydropower is so effectively and has the potential to produce electricity in rural areas. Further, they introduced the micro-hydro power as clean and environment friendly source. Their discussion shows hydro power can play a important role in sustainable development and provide reliable energy in rural areas, and the implementation of micro-hydro power will reduce the cost of energy per KWh, and mitigate the cost of supply system. [5]

Hassan F. Khan, C. Ethan Yang, evaluated the Kabul, and Kunar river for possible construction of hydro power plants and generating of electricity as the rivers have ample potential of hydro power in their paper "Case study on hydro politics in Afghanistan and Pakistan" furthermore, they expressed the huge potential of hydro power in Kunar river for generating of electricity. also, they studied Kabul river under various climatic condition for generating of electricity, they studied the shared boundary water management and scenario in these both countries. [6]

Sultan Mahmood Mahmoodi, in his research "integrated water resources management for rural development and environmental protection in Afghanistan" studied Afghanistan water sources for generating of electricity also he analysed problems water management and the effecting factors in the country water management system. [7]

Vick, M. J. in his study titled "Steps towards an Afghanistan–Pakistan water-sharing agreement" discussed the problems over trans-boundary between Afghanistan and Pakistan. Additionally, he analysed the climatic impacts over Kabul river and it is consequences in Kabul river basin. [8]

Methodology

In this paper we analysed the potential and current status of hydro power in Afghanistan, the establishment of hydro power plants are expected to be increased. The country has very good potential in Kunar, Kukcha, and Ammo rivers, which can generate a huge amount of electricity across the country. the donors are obligated to invest on exploring of renewable sources in the country, specially, hydro power plants.

The statistics from NSIA shows, in 2019 the hydro power plants generated a huge amount of electricity which is good news for the country.

Table 2

Current status of hydro power in Afghanistan. [9]

S. NO	Electricity Establishment	2017	2018	2019
1	Naghlo	241.61	231.84	411.48
2	Maheeper	107.52	69.66	167.38

S. NO	Electricity Establishment	2017	2018	2019
3	Sorobi	173.18	171.07	158.39
4	Pul-e-Khumri	23.30	21.76	23.08
5	Kajaki	248.80	220.28	206.06
6	Daronta	47.38	38.72	34
7	Salma (Dosti)	75.67	14.14	75.82
8	Charekar	1.03	4.06	1.04
9	Jabul Seraj	0.30	0.21	2.65
10	Ghorband	0.21	0.17	0.11
11	Kunar	1.69	6.19	4.04
12	Chak I Wardak	1.28	0.96	0.73
13	Badakhshan	1.93	2.09	1.11
14	Gareshk	5.99	4.65	
15	Takhar			0.41
16	Nuristan			0.42
17	Baba Wale			0.35
Total		929.88	785.79	1088.04

Although, the country is engaged in war for almost three decades, still the energy sector is developing and working for better future in the country.

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Table 3

The potential of hydro power and future planned hydro power plants. [10]

S. NO	Power plant	River	Estimated installed capacity (MW)	Estimated cost of refurbishment ($1*10^6$) USD
1	Naghlu	Kabul	100	90
2	Sarobi	Kabul	22	25
3	Mahiper	Kabul	66	80
4	Darunta	Kabul	11.5	14
5	Assadabad	Kunar	0.7	1.2
6	Charikar	Ghorband	2.4	3.6
7	Jabul Seraj	Salang	2.5	3.6
8	Ghorband	Ghorband	0.3	0.6
9	Kajaki (1&2)	Helmand	33	40
10	Grishk	Helmand	2.4	3.6
11	Pul-i-Chomri	pulikhumri	4.12	6
12	Pul-i-Chomri 2	Pulikhumri	8.79	13
13	Baghdara	Panjshir	210	600
14	Surobi 2	Kabul	180	700

15	Kunar A (Shal)	Kunar	789	2000
16	Kajaki Addition	Helmand	100	300
17	Kukcha	Kukcha	445	1400
18	Gulbahar	Panjshir	120	500
19	Capar	Panjshir	116	450
20	Kama	Kunar	45	180
21	Kunar B (Segai)	Kunar	300	600
22	Kajaki Extension	Helmand	18.5	90
23	Olambagh	Helmand	90	40
24	Kilagai	Kilagai	60	250
25	Salma	Hari Rud	40	200
26	Upper Amu	Amu Daria	1000	2500

Conclusion

The potential of hydro power is ample and the current supply system is more depending on imported electricity from neighboring countries, the demand is expecting to increase in the future as the country is going to be more industrialized, population growth is another impact of forcing the sector to provide more energy. And currently the country is struggling to supply energy even in the capital Kabul. The best way to produce reliable energy and meet demand is exploring of renewable resources. Afghanistan has a good potential of renewable energy, but unfortunately the resources are still unexplored and the country face many problems in energy sector. Most of the rural areas are still using conventional system of energy which consist a heavy burning of fossils and wood firing and produce a huge amount of CO2, and other Green House gases (GHG). After sealing of Taliban regime Afghanistan energy sector again stand on feet and working to develop and maintain the energy supply system in a sustainable platform. Recent statistics shows that energy sector with the help of foreign donors is working together for sustainable and reliable energy supply system. fortunately, the consequences are so promising. Our study aims to introduce the hydro power as capable energy source and suggest the energy sector to make hydro power in their priority.

Distinguished features Hydro power in Afghanistan:

1. The hydro power resources are capable for generating enough electricity to meet the demand.
2. Generating of electricity from hydro power is one of the clean and efficient way of generating electricity.
3. Hydro power plants do multi tasks, such as energy production, irrigation water supply, and helps water resource management.
4. The construction of Dams, help local farmers to irrigate better, and also reduce the floods crisis.
5. The operational cost is quite low as compared to other renewable technologies.

Hydro power plants can be a profitable source for energy sector and can help the country to be more industrialized and make the supply system more reliable. The energy sector should attract more investor from domestic and international to invest on hydro power plants in the country in the future.

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BIOGRAPHIES

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