



Research paper

Afghanistan electrical energy and trans-boundary water systems analyses: Challenges and opportunities

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ABSTRACT

Afghanistan is a major country in the central Asian region and its ability to become a bridge between south and central Asia is critical to any form of development and inter-regional collaboration particularly in the energy sector. History has not been kind to Afghanistan and it is a less developed country with poor governance and weak institutions. However, today there are opportunities to overcome the legacy of the past and seize the vicious circle of economic regressions and political violence into enhanced political stability and economic development.

Afghanistan has sufficient energy resources to provide reliable electricity to its people and industries. Based on MEW estimates it has about 318 GW of renewable energy production capacity. Along with renewables there are significant hydrocarbons and coal resources. But despite the possession of these resources the country has remained underdeveloped with a low electrification rate of only around 30–38%. The deteriorating security conditions remain the main impediment to all the development incentives including the energy sector. The energy sector has technical, financial and institutional constraints. In addition, the trans-boundary water management issue remains a key obstacle for hydropower potential utilization.

Almost all rivers of Afghanistan are shared with neighbor countries and except with Iran there is no trans-boundary water sharing agreements with other recipient countries. This has hindered hydropower utilization of Afghanistan. Furthermore, considering weak financial institution of Afghanistan it is a distant possibility for Afghanistan to finance the hydropower projects by its own. Therefore, water sharing disputes resolution with neighboring countries should be the first priority for Afghan government to attract global financial institutions investments.

Cooperation grows from communal interests, and south and central Asia are united in the common benefits that both regions will get from energy trade and eventually regional prosperity. Afghanistan is well placed in adjacent proximity to the major hydropower and gas producer states which are desperate to diversify and reach central Asian markets. The country could become a hub of energy transit between the energy deficit south Asia and the energy surplus central Asia.

The qualitative research approach has been followed to analyze and find out the key problems and opportunities of the sectors along with PESTLE and SWOT analyses.

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1. Chapter one: Background and introduction

1.1. Chapter introduction

This chapter provides the overall background of Afghanistan electrical energy system. Furthermore it highlights the research objectives, problem statement and motivation.

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1.2. Background

Afghanistan is a land-locked country located within central and south Asia. Afghanistan has 32.53 million populations with \$20.04 billion Gross Domestic Product (GDP) (World Bank, 2015). Because of its strategically important geographic location throughout the years this country has been a victim of political, strategic and economical battle field between fierce empires.

Starting from the invasion of Alexander the Great in 330 BC (Mehrabi, 2012) followed by several others such as Genghis Khan, Mughal Empire, Timur, Persian empires and continued by British Empire invasions in last century 1839–42; 1878–80; 1919. British

Acronyms and abbreviations

ADB	Asia Development Bank
AEP	Annual Energy Production
AFG	Afghanistan
APA	American Psychological Association
BBC	British Broadcasting Corporation
Bbl	Barrel (42 US gallons)
BP	British Petroleum
BWT	Boundary Water Management Treaty
CAPS	Central Asian Power System
CASA	Central Asia South Asia
CF	Capacity Factors
CHN	China
CRE	Community centered Renewable Energy
DABS	Da Afghanistan Breshna Sherkat (National Utility)
Et al	Et alii (And others)
Etc	Et-cetera
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GHI	Global Horizontal Irradiance
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GoA	Government of Afghanistan
GW	Giga-Watt
HR	Human Resources
HVDC	High-Voltage Direct Current Technology
ICE	Inter-Ministerial Commission on Energy
ICES	Inter-ministerial Commission of Energy Secretariat
IJC	International Joint Commission
IMF	International Monetary Fund
IPI	Iran–Pakistan–India Pipeline
IRN	Iran
KM	Kilometer
kWh	kilo-Watt-hours
kWh	Kilowatts hour
MCC	Metallurgical Corporation of China
MEW	Ministry of Energy and Water
MoE	Ministry of Economy
MoF	Ministry of Finance
MoM	Ministry of Mines
MW	Megawatt
MWh	Megawatt Hour
NATO	North Atlantic Treaty Organization
NCAR	National Center for Atmospheric Research
NEPS	Northeast Power System
NREL	National Renewable Energy Laboratory
PAK	Pakistan
PESTLE	Political, Economic, Social, Technological, Legal and Environmental
SADC	Southern African Development Community
SCO	Shanghai Cooperation Organization
SEPS	South East Power Grid
SPG	Western Power Grid
SWOT	Strengths, Weaknesses, Opportunities and Threats
T&D	Technical and Commercial
TAJ	Tajikistan
TAPI	Turkmenistan–Afghanistan–Pakistan–India Pipeline
TCF	Trillion Cubic Feet
TCM	Trillion Cubic Meter
TUM	Turkmenistan
TUTAP	Turkmenistan–Uzbekistan–Tajikistan–Afghanistan–Pakistan

TWh	Terawatt-hours
UK	United Kingdom
UN	United Nations
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
US	United States
USAID	United States Agency for International Development
USD (\$)	United States Dollar
USGS	United States Geological Survey
USIP	United States Institute of Peace
UZB	Uzbekistan
WB	The World Bank
WBG	World Bank Group
WM	Water Management

Empire has invaded Afghanistan three times seeking to block the Russian Empire influence and to demonstrate its supremacy in central Asia (Stewart, 2011). Then in (1979–89) after the Soviet Union invasion it has become the center field of the Cold War (Stewart, 2011) and currently remains under the US-led invasion started from 2001. For them these were “The Great Games” for some Afghanistan portrayed as the “Graveyard of Empires” (Berdend, 2001). But ultimately the Afghans have endured huge losses as the real victims of all these atrocities and are still suffering. The recipe of continuing instability is indefinite occupation in a land that long has been remained hostile to occupiers.

Because of the decades conflicts almost all of Afghanistan's energy (Generations, Transmissions and Distributions networks) infrastructures and related academic institutions have been destroyed. Since the start of reconstruction process in 2001 International Community has pledged USD 62 billion aid for Afghanistan reconstruction in 2002 to 2013 period (Poole, 2011). Although, since last 15 years preliminary steps have been taken to develop Afghanistan energy system but the sector still remains vulnerable and underdeveloped. And still more than 70% of the population lives without connection to electricity grid. The current administration of Afghanistan considers investment in energy field as an influential sector to the country stability and long term economic growth.

Afghanistan possesses rich energy and other minerals resources; a United States Geological Survey (USGS) suggests more than one trillion USD worth of untapped deposits while Afghan government foresees more than three trillion USD of untapped worth mines. The resources are sufficient to fundamentally change the country energy, economy and security situation (Risen, 2010). Hydroelectric power potential of Afghanistan is estimated in excess of 23,000 MW¹ along with excessive solar and wind energy potential (DABS, 2011). Based on Afghanistan Power Sector Master Plan, in 2032 Afghanistan electricity peak demand will reach around 3500 MW (Fichtner, 2013). Only renewable energies utilization is more than sufficient to fulfill Afghanistan electricity demand.

However, Afghanistan electrical energy sector is still facing huge challenges and complex set of problems associated with unstable security condition and higher dependency on import power from neighbor countries (Turkmenistan, Tajikistan, Iran, Uzbekistan, and Kyrgyzstan). Where, Northeast Power System (NEPS) a key transmission link to the capital Kabul and north region in 2011 has imported 70% of its required power supply (Irving and Meier,

¹ MW equals one million watts.

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