Renewable Energy for sustainable Development

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Abstract:

This paper highlights the potential of renewable energy Utilization and its key role in the Economic development in Afghanistan particular within the rural areas where 80 percent of the population does not have access to energy and meeting their energy demand through traditional biomass. It will also touch upon the importance of Afghanistan geographical position between the South Asian and Central Asian developing countries.

Through this paper, it has been researched in depth that how productive use of electricity stimulates the economic development in rural areas, and how to utilized the high potential renewable energy available in Afghanistan for sustainable Economic Development.

KEYWORDS: (Potential of renewable energy, Sustainable Economic development)
**Introduction:**

In Afghanistan a negligible part of the population has access to electricity and mostly those residences living in the large cities connected with grid. Comparing access to electricity in the region and global average Afghan people Access to energy is one of the lowest in the world. The present generated and imported energy met merely 26 percent of the population demand.

There is expected to be a huge gap persist in the demand and supply of energy for Afghanistan in present and long run which is likely to be met through increasing current energy generating capacity and imports at one way and investing in on the renewable energy mainly in the rural areas. However, it’s more dependent to the future peace and stability in the region and financial commitments of donors and Afghan economy.

Afghanistan location as a strategic point will generate jobs and revenue in the coming short and long term period. The cross border agreements such as TAPI, CASA 1000 and other future agreements between the south Asian and central Asian region will benefit Afghan people to generate income and take comparative advantage. However, Security and instability in the region remain one of the key challenges.

Renewable energy has high potential to economic development. Wind and solar along with other resources are identified to generate electricity in the west and north region. The satellite assessment indicates that west and south has high potential for generating electricity. The Afghanistan national development strategy emphasis on the role of renewable energy in the future economic development.

Access to electricity is expected to stimulate economic growth. The word bank projects proved to be successful in Sri Lank and Bangladesh. Access to electricity will be start the engine of economic growth; Small and medium enterprises. There is millions of Afghan engaged in the Agriculture, manufacturing sectors which require electricity for their business. An example is the agriculture products packaging and cool keeping store for their fruits. At the same time carpet industry is another example where millions of Afghan women are professional in this business, but due to lack of access to resource particular electricity the majority of Afghan women are living below poverty line.
3. Afghanistan – Energy Sector Overview

3.1 Current Status.

Only 26 percent of the Afghan population has access to electricity, one of the lowest in the world. Though, the number of households that have access to any source of electricity has grown rapidly since 2005. Still, Per head power consumption is less than 30 kWh/year in comparison to Pakistan 449 kWh, India, 684 Kwh, Germany, 7081 kWh, Iran, 3649, Turkmenistan, 2444 kWh, Tajikistan 1714 kWh and Word average 3060 kWh Per year. In 2005, NRVA reported 23 of households have access to any source of electrical power. The corresponding figures reported by NRVA 2007-08 and 2011-12 increased to, respectively, 42 and 69 percent, a three-fold increase in six years’ time. Around 64 percent of rural households and 95 percent of urban households have access to any source of electricity. However, only 5 to 9 percent of rural people have access to electric grid.

Figure 3.1

The main source for which use have increased are the electric grid (from 15 in 2005 to 26 percent in 2011-12) and renewable solar and wind power (mainly solar; from virtually noting to 22 percent). The electric grid is primarily and urban source of electrical power (44 percent in 2007-08 and 85 percent in 2011-12, compared to the rural figures of, respectively 5 and 9 percent), while solar
power is concentrated in rural areas (3 percent in 2007-08 and 29 percent in 2011-12, compared to the urban figures of, respectively 0 and 4 percent).

3.2 Generation and Imports.

Afghanistan imports 345 MW of electricity from Uzbekistan, 300 MW Turkmenistan, and 300 MW Tajikistan. While the remaining current electricity is met by internal generation (Hydro Power Plant, Solar, Wind, Diesel Generator). Pul-Khumri (Hydro 9MW), Darunta Hydro power plant 11.5 MW, Kabul (Thermal )north west Power plant 45 MW, Kabul (Hydro ) Mahipar 66MW, Surobi 22 MW, Naglu 100 Mw and others (Fig 3.2) which existing Hydro Power plants total makes 252,6 MW.

Fig 3.2

The entire electricity infrastructure in Afghanistan, except for a few pockets was destroyed due to the ravages of war. The focus right now is to rebuild the distribution system in the major cities and towns to build transmission system to bring power from the generation facilities within the country and to bring the imported power from transmission system.
The Ministry of Energy and Water (MEW) manages controls and operates the power of Afghanistan through nine departments and four public sector organization, of which Da Afghanistan Breshna Shirkat (DABS) is the largest. DABS is responsible for the generation, transmission, and distribution of electricity; operation and maintenance of assets; sales of electricity and revenue collection. The international community is supporting Afghan Energy capacity building program since 2008. The major donors are Word Bank, Asian Development bank, USAID, India, Iran and Korea. Each of donors supported a particular Transmission line from Uzbekistan, Turkmenistan, Tajikistan, and Iran.

3.4 Potential Supply and Estimated Demand

Existing facility provide unreliable services meet a minor proportion of population demand mostly to urban population which makes 22.7 percent of the population. While rural Population (71.8) percent have only 9 percent access to electricity. By the year 2020 the estimated demand for Afghanistan is around 6000MW assumed to be met by improving the present installed capacity and imported from the Central Asian countries.
Afghanistan will benefit from its strategic location between the South Asian and central Asian countries in the future. However, there are four transmission interconnection between the central Asian countries and Afghanistan; one each from Tajikistan and Uzbekistan and two from Turkmenistan to Afghanistan. There are other three interconnections between Iran and Afghanistan. All these haul transmission system would entail large investment, which the government cannot afford at the moment. A transmission system capable of to handle the power imports needs of Pakistan and India shall have to an Independent system with loop-in and / or loop-out interconnections facilities along the line to help Afghanistan to evacuate small quantities of power to serve adjoining areas along the transmission line within Afghanistan.

Fig 3.4

3.5 Bridging the Gap between Demand and Supply

Connecting dots between demand and supply of Afghanistan energy sector is correlated with political, Economic and Security stability. At the same time regional cooperation, international community commitment for social- Economic development, good governance and institutional capacity building are vital for the future infrastructure and social developments projects.
Taking into account the supply-demand scenario of the two regions are complementary. The south Asian countries have surplus electricity available for exports through the year 2025. The surplus electricity available for trade among the four central Asian countries ranges from 9,429 GWh in 2005 to 23,178 GWh in 2025. While the situation within the south Asian countries, Afghanistan, India, and Pakistan is the exact opposite, requiring continued electricity imports for the foreseeable future in order to bridge a demand-supply gap.

3.5 Cross-border Trade and Transit Agreement.

Kazakhstan, Turkmenistan and Uzbekistan are energy rich countries with large hydrocarbon reserves; Kazakhstan have significant hydropower potential. Intra-regional electricity trade is taking place among these Central Asian countries, and small volume is traded with countries outside the region. But, this trade is far below the actual potential. Central Asian countries need to look beyond their own region to harness the full potential of their energy resources. In relation to electricity an important and proximate market with a growing demand for imports is in south Asia, especially Afghanistan, Pakistan and India. There is a natural foundation for energy sector cooperation between the Central Asian countries and these South Asian countries.

Afghanistan’s strategic position advantage will benefit the country directly or indirectly in the future cross-border and Transit Agreement. A good example of such advantage is the TAPI (Turkmenistan, Afghanistan, Pakistan and India) natural gas pipeline project which cross from Afghanistan to Pakistan to reach India. This project will provide the opportunity for Afghanistan to gain 300MW of power and would directly address Afghanistan’s need for power, and might also help to lay the groundwork for an eventual natural gas pipeline. Such project could generate $100-$300 million per year in transit fees for Afghanistan at the same time create hundred thousands of employment and investment opportunities across the region. However, the key challenge for such Agreements is Security instability in the region which requires high level of regional cooperation.

CASA-1000 is another future project that transit 1,000 megawatts of surplus electricity from Tajikistan and the Kyrgyz republic to Pakistan, with power transiting through and energy deliveries happening within Afghanistan. Kabul would have a substation, which initially would receive approximately 100 MW going up to about 100 MW. Over the life of the project about 90% of the power would be used by Pakistan while, 10% would be taken by Afghanistan. With 562 km of HTDC transmission, Afghanistan has the largest share of CASA-1000 transmission lines, representing about 52% of the total project cost. Afghanistan
would receive common equity of $59.8 million and begin receiving dividends following a grace period.

Aynak Cooper Mine is another big project invested by China. The Chinese (MCC) company will exploit the coal mine in north Hindkush and build coal power where projected capacity is around 400 MW.

The Afghanistan National Development strategy recognizes the priority of electricity supply projects and develops the mechanism to ensure coordination among the other government entities as required. Reducing technical losses in transmission and distribution, metering of existing cross border transmission, expanding transmission capacity to neighboring countries, developing new hydro power capacity and investment in oil, natural gas and coal infrastructure based on tenders using performance contacts and permitting system are the priorities objective.


From Sustainable development perspective, a sustainable energy expansion needs to increase the availability of energy services to groups that currently have no or limited access to them. The poor, those in rural area and those without connection to grid. In Afghanistan Significant part of the rural population today have no or limited access to modern and clean energy.

In the context of Afghanistan, 85 percent of the energy demand are covered by traditional biomass (wood, Dung, others). According to the NRVA national Survey, Majority of the rural people use solid fuels for heating and cooking in homes which result in incomplete combustion and hence in the emission of hundreds of compounds, some which may induce cancer and other health problems. It also produces greenhouse gases that contribute to global climate change.

Table (10.6) provides the percentage of the population using solid fuel for both cooking and heating, except urban households who primarily use gas for cooking. For rural household, bushes, firewood and animal dung – in order – are the most important cooking fuels, whereas firewood is the preferred fuel for heating, followed by bushes animal dung. For urban households, next to firewood as the primary source for heating, charcoal is a second important fuel. For Kuchi household’s animal dung is the most important source for both cooking and heating.
Table 10.6: Population using solid fuels for (a) cooking and (b) heating in winter, by residence (in percentages)

<table>
<thead>
<tr>
<th>Residence</th>
<th>(a) Cooking</th>
<th>(b) Heating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban</td>
<td>32.5</td>
<td>99.1</td>
</tr>
<tr>
<td>Rural</td>
<td>93.4</td>
<td>92.3</td>
</tr>
<tr>
<td>Kuchi</td>
<td>99.8</td>
<td>100.0</td>
</tr>
<tr>
<td>National</td>
<td>79.9</td>
<td>97.4</td>
</tr>
</tbody>
</table>

Renewable Energy and Utilization

The National solidarity program (NSP) is the “largest People’s project in the history of Afghanistan created in 2003 by the Ministry of Rural Rehabilitation and development to develop the ability of Afghan communities to identify, plan, manage and monitor their own development projects. The NSP receives funding from four primary sources; the word Bank’s international development association, the Afghanistan reconstruction trust fund, the Japanese social development fund, and bilateral donors. The total NSP budget for the period from May 2003 to September 2015 amounts to US$ 2.5 billion.

As of 21st June 2014 NSP have completed 6,941 Projects in power sector amounted more than 7 Billion Afghani and, yet 6,817,922 million rural people have benefited from these projects. In addition, 8,037 more power generating projects have been targeted which projected more than 9 billion Afghani funded by the donors and more than 8 million rural residence will benefit it.

Hydro power:

The theoretical potential estimated around 25 GW (both big and small hydropower). Currently about 304 MW installed capacity; about 183 MW are operating from this small hydro power is generating about 45 MW at the present capacity.
Small, Mini and Micro Hydro Power Programmes:
A number of micro-hydro systems have been installed in villages in central, north and northeast Afghanistan over the past ten years, with at least 30 Afghan manufactures located throughout the country manufacturing inexpensive cross-flow turbines and associated components sufficient to produce between 3 and 50 kW of power. Since 2003, the provincial reconstruction teams (PRTs) funded by USAID and implemented by local NGOs have installed over 125 micro – hydro power units in Afghan villages at an average total cost of equipment and materials of about $ 3,300 per village, not including the costs for design, technical assistance, community development and training. Untapped water resource provide new opportunities for exploring mini – and micro – hydro power (MHP), a comparatively low cost and readily available technology, as a major renewable energy resource for rural Afghanistan.

Solar Energy

Afghanistan also has significant solar resources, averaging 300 days of sunshine per year. This solar radiation is estimated to average 6.5 kWh per square meter per day. Solar heaters and solar photovoltaic cells could be important sources of energy for the country both for off grid and potentially large solar plants connected to the grid. Currently, the biggest program supporting solar energy projects is NSP: more than 2000 individual projects for the dissemination of solar home system in the range 20 till 40 W implemented; in total about 103 kW electricity for lighting supplied. Solar energy has very high technical potential
but economically feasible only in the absence of hydro and main grid resources.

**Wind Energy**

Wind resources in Afghanistan show promise on the basis of satellite data. The lowland areas in the south and west have around 120 windy days per year, with average velocities of four meters per second. Seasonal dusty winds maybe as high as 6.5 - 9 meters per second around western, northern and central provinces of Afghanistan, but with average still around four meters per second. 158 GW electricity production is theoretically possible.

High theoretical potential particularly in the West like Heart, Farah (at the border to Iran with its 120 days - winds); 158 GW electricity generations is possible (at wind speeds above 7 meter per second in meter height). However, it’s very dependent on micro climate; projects need long lead time for measurements. Households system (egg. Up to 500 W) are more complicated in maintenance (sand, dust) than solar – photovoltaic system; solar – wind – hybrid system is most feasible. But, big wind power needs a power grid to feed in the electricity.
Economic Development through Renewable Energy

Productive use of electricity stimulates the economic development in the rural area. The world bank projects on renewable energy for Economic development was successful. A good example is rural economic development project for Sri Lanka that improved the quality of rural life by utilizing off-grid renewable technologies to provide energy services to remote communities and promote private sector power generation from renewable energy resources for the main grid. At the same time, the rural electrification and renewable energy development project in support of Bangladesh' efforts to raise level of social development and Economic growth by increasing access to electricity in rural areas.

Increasing the share of renewable energy as a source of power generation will likely accelerate further reductions in Carbon emissions? According to the United Nations industrial development organization (UNIDO), 26% of the total reduction in Carbon emissions worldwide in 2010 was on account of efficiency gains in renewable energy sources.
In Rural areas, the transmission and distribution of power generated from fossil fuels is very costly. Therefore, using off–grid renewable energy sources in rural areas will help increase access to basic services, including lighting, communications, and water pumping. The use of these increasingly affordable technologies would facilitate the integration and development of Afghanistan rural populations.

Electricity supply to rural areas in Afghanistan stimulates economic development particular through use of electricity for production in mini and small business. Small and medium enterprises are the engine of economic growth which is possible to be on truck trough having access to electricity in the rural areas.

In Afghanistan the proportion of population below the national absolute poverty line is 36 percent, meaning that approximately 9 million Afghans are not able to meet their basic needs. While 36 percent of the population cannot meet basic consumption needs, there are many more people who are highly susceptible to becoming poor. While majority is rural residence. Access to electricity in the rural area will create new opportunities. At present there are millions of Afghan women and men having rich skills to generate income, however, due to lack of access to resources particularly Access to electricity and micro finance become vulnerability and poverty.

**Conclusion:**

Afghanistan has high potential for renewable energy. This will provide the opportunity to deliver cost effective electricity to the Rural population where majority is living below the poverty line and 80 percent of them do not have access to energy and cover their energy demand by traditional biomass (for example wood, dung). Using such biomass induce health and climate change challenges.

The gaps between energy demand and supply may be filled by generating electricity through renewable energy access across the rural areas which has high potential. Further, Renewable energy will generate income through providing investment opportunities to the local and international investor. Further, the Afghanistan position as a strategic point will increase public revenue and job creation as the south Asian countries require energy and the central Asian region is the optimal place to import through Afghan territory.

Access to electricity is expected to stimulate huge economic growth. The Afghanistan government with the support of international community is encouraging power generating projects in the rural areas. The National Solidarity
program is the largest project program across the country in the past one decade providing basic need to the rural population. At the same the provincial reconstruction team of the donors country have invested huge amount of money in the rural areas to generate power. Power access not merely has direct effect on the lives of rural people such as income generation and investment, at has also effect on the level of education, access to health care and communication.

One of the key challenges faced today and maybe in the future toward socio and economic development in Afghanistan and in the region is security concerns. The future of the economic empowerment is more dependent to the stability of the region. Many research indicates that the south Asian countries and Central Asian countries standing at the opposite position. The south Asian countries such as India, Pakistan, and Afghanistan are facing energy deficiencies while the central Asian countries are having surplus energy. The future cross - border agreements will most likely depend on the future stability in Afghanistan and the whole region.

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