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UNITED NATIONS CONFERENCE
on New and Renewable Sources
of Energy

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NATIONAL PAPER

Democratic Republic of Afghanistan

Summary and Conclusions

1. Afghanistan is one of the land-locked least developed countries with per capita income of about \$155 per year. It has an area of 653,000 square kilometers and a population of about 15.5 million people.
2. Agriculture is the backbone of economy, with 80% of the population dependent on agriculture, livestock, handicrafts, and rural trade.
3. For economic development of the country, the large sector of rural population needs attention. Energy will play a key role in the rural development as it can provide power for use of the ground water, lift irrigation village level small scale industries, handicrafts, thrashing, milling, agro-industries, domestic use etc.
5. The present average power consumption per capita is only 60 kWh/year, which is one of the lowest of the world. This is mostly in urban or around urban areas, with practically no power reaching 80% rural population. There is thus an urgent need to supply power to the rural areas.
5. Afghanistan has many areas with 120 windy days and some areas with as much as 250 sunny days. There is thus great potential of development of solar and wind energy.
6. Traditional use is made of animal waste and plant remains in a primitive manner. Improved techniques can give greater efficiency. development of biogas and biomass energy is necessary.
7. There is potential of hydro-power but due to hydrological conditions, storage dams are needed for power generation, which take 10-15 years from reconnaissance surveys to completion. Rural areas, which are so poor cannot wait for such long periods. Otherwise also, hydro-power cannot reach all villages due to remote location and topography. New and Renewable Energy Sources which can be developed in much shorter time, and with lower investments, are thus prepared.

8. Afghanistan supports the use of new and renewable sources of energy, especially for rural areas but lacks technical know how and financial resources.

9. Substantial technical and financial assistance is needed by Afghanistan in the development of new and renewable sources of energy, such as regional research and investigation centres, facilities for collection of basic data, transfer of technology, training facilities in Afghanistan and training fellowships abroad, equipment, demonstration facilities etc.

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Introduction

Afghanistan is a land-locked country with Pakistan in the east and south, Iran on the west and USSR in the north, and arid conditions in most parts. With Hindukush mountains sprawling in the centre of the country and deserts in the south and south-west, only one eighth of the geographical area of the country is cultivated. Land is therefore scarce, but scarcer still is water which limits cultivation. Much of the water comes from rain and snow-melt, availability of which varies from year to year. Nevertheless, the land can produce enough of the basic cereals for the needs of the people and flocks, in a good climatic year. Being essentially an agrarian country, farming and non-agricultural activities are carried out by self-employed household production units or enterprises, which are typical of developing agrarian economies, with custom of work and income sharing among household members. In spite of the sturdy and hardworking people, about one third of the rural population is very poor.

The country has an area of 653,000 square kilometres, with a population of about 15.5 million. Geographically, the country can be divided into four broad regions, the northern plains, central mountains, eastern and south-eastern mountains and southern and western lowlands. Northern plains are relatively low, and have altitude of about 350 m above sea level, but central mountains range from 4000 to 5000 m in altitude. Eastern area has elevation varying from 1200 to 2000 m. The south and western lowlands comprise the biggest block, which is sparsely populated and has far hotter and drier climate as compared to the rest of the country.

The per capita income for the country is about \$ 155 per year. Conditions can improve only with rural development, by raising the capabilities of the households to earn more. In doing so, energy will play a key role. With availability of energy, village industries and handicrafts can develop, groundwater can be pumped for irrigation, lift irrigation schemes can bring higher areas under cultivation by lifting water from rivers or the canals. The sources of energy thus need careful investigations and economic study.

Afghanistan's main energy resources are coal, natural gas, and hydro-power; petroleum reserves so far identified are minor. In addition, there is use of the traditional fuels such as fuelwood,

charcoal and agricultural and animal wastes. With the rising prices of oil products, and shortage of availability of electric power for the growing needs of the population, pressure on the forests has increased and large scale exploitation is taking place, without adequate arrangements for afforestation.

Coal mining is the oldest established of the fuel industries having started more than 60 years back. There is no coal fired thermal plant as yet but some are planned. Cost for domestic use of coal is high due to lack of modern mining techniques and long haulage distances to consumption areas.

There is considerable hydro-power potential but development needs heavy investments. Selected projects have been taken in hand according to the availability of the financial resources. Completion of these projects will primarily help urban areas and hardly touch the fringe of the need of 80% rural population. The New and Renewable Sources of Energy (NRSE), such as wind energy, biogas, biomass, solar-thermal and photo voltaic, geo-thermal, micro hydel thus need urgent and careful consideration. Energy could be supplied to many remote villages, to which transmission lines will be costly, by using a source appropriate to the location and climatological condition of the village. Afghanistan has about 125 windy days and 250 sunny days in some areas. There is thus good scope for development of wind and solar energy. These sources need to be extensively developed for which technical know how, experimental and demonstration facilities, and financial assistance are lacking.

2. Present Status of Energy Generation in Afghanistan

The present annual power consumption is about 60 kwh per capita, which is one of the lowest in the world. Bulk of the power generated is hydro. There are isolated diesel generating sets for cities not connected with hydro-power transmission network. Some other cities have gas or oil fired thermal units. There is no coal fired thermal station as yet.

At present, Afghanistan's electric power stations, operate in isolation or on semi regional basis. The country doesn't

have any national network. The Afghan Electricity Authority (DABM) divides the country into eight administrative regions called "Breshnas". In general, each region has one or two major load centers and several minor ones.

The existing installed capacity in the country is about 390 MW, as follows:

-- Hydro power stations (HPS)	254 MW	65%
-- Thermal power stations (TPS)	86 MW	22%
-- Diesel power station (DPS)	50 MW	13%
	<hr/>	
T O T A L	390 MW	

Their total production for 1359 (21 March 1980 - 20 March 1981) was 910 million kwh. The production at the source was:

-- HPS	652 mln.	kwh
-- TPS	250 "	"
-- DPS	8 "	"
	<hr/>	
T O T A L	910 mln.	kwh

This production couldnot satisfy the increasing demands of the consumers.

Details of the various types of generations are given below:-

a) Hydro - Power

Potential for development of about 23,000 MW of new hydro electric generating capacity has been identified in Afghanistan, in various studies in recent years. Of this potential, 18,000 MW are located on the Panj and Amu rivers along the international boundry between northern Afghanistan and the USSR. The sources for the remaining 5,000 MW are located primarily in

two areas, (i) Kokcha river 1,900 MW and (ii) 3100 MW on Kabul river basin on the southern slopes of the Hindu-kush.

At present, the existing hydro power stations in the country utilize only 250 - 260 MW of the total hydro potential. Afghanistan needs construction of new hydro-power stations to utilize its hydro power resources and to satisfy the demands of the consumers.

b) Thermal Power

The thermal generating capacity of 86 MW, is made up of gas turbines at Kabul presently run on crude oil and gas fired thermal station at Mazar Sharif. There is a proposal to have coal fired thermal station in Herat region in the West.

c) Diesel Stations

Diesel power stations are located at important towns and work in isolation only for those towns. Diesel being imported, cost of generation from these stations (total 50 MW) is high.

3. Energy Potential of Afghanistan

a) New and Renewable Energy Sources

i) Traditional Utilization

Some of the sources of energy in Afghanistan have been utilized by the people for centuries. They have naturally gained experience but have never had enough scientific knowledge for appropriate and extensive utilization, or could have not afford the necessary expenditure. The following are some of the sources of energy traditionally utilized in Afghanistan.

ii) Fuelwood

Burning of the wood is the most widespread traditional way for obtaining energy for cooking and heating. The people from the lonely villages are still using open fire, which is not economical utilization of the wood. In most rural areas, the people build fire places from clay and stones, for cooking and heating. However good room heaters made of metal, locally designed & built are in great use, for burning wood.

The largest wood regions in Afghanistan are Paktia and Spinghar (Nangarhar area). All over the year, wood is carried from these places for trading. Because of the absence of a reforestation programme, the availability of the wood is decreasing sharply.

During the middle ages, Afghanistan was rich in forests and most of its territory was completely covered by woods. At that time, a Chinese traveller Huan Teing Zia crossed Afghanistan on his way to unknown lands, and wrote that Afghanistan had been covered by thick set trees, which made his travel difficult.

Bit by bit, the forests are getting depleted. Some areas have only fruit trees. The Amu Daria valley, which was rich with woods, is completely deserted now.

The deforestation of the country has changed the climate. The climate is dry and the air is full of dust. Instead of forests, one can see many deserted and uninhabited areas.

Government is trying to establish legislation to prevent deforestation. If cutting of the trees continues at the present rate, no fuel trees will exist in Afghanistan after 6-10 years, which will be a serious matter. Advice on the rules and regulations, for restrictions on cutting of trees, and pursuance of a national programme for planting of new forests in the country, are thus necessary.

iii) Charcoal

Charcoal has been manufactured from wood, since many years, in Afghanistan. It has been the main and the only source of energy for certain needs of the people.

The production of charcoal is undertaken by primitive techniques. A pit is dug in the ground and filled with wood. It is covered back by earth in a way that the wood should not be in contact with the outside air. After lighting the woods, the burning should be very slow process for proper obtaining of the charcoal.

The charcoal is used for cooking, heating, charcoal irons, etc. The present practice of charcoal production results in substantial wastage. Advice on appropriate techniques of charcoal production, is very essential for Afghanistan.

iv) Biomass Energy

Energy of biomass is used mostly in rural areas. Its utilization goes back quite a long way. The utilization of biomass energy in Afghanistan could be divided into two main groups:

A. Animal Waste

Animal waste (dung) is being completely utilized all over the country for two purposes:

- fertilizer
- fuelling

Usually the people collect the animal dung, dry it and use instead of wood for cooking, warming etc. This way of utilization of animal waste is very popular and widespread in Afghanistan.

B. Plant Remains

The main plant remains used by the rural communities are from:

- corn (maize)
- beetroot
- sugarcane
- cotton

The remains dry in the sun, after which these are used as fuel, in the same way as animal waste.

More attention needs to be paid to the different biomass resources in the country, as these are important energy resources, with low cost. Design of appropriate techniques for utilization of biomass energy in Afghanistan is necessary. The species of the plants which have quick growth also need to be investigated.

v) Wind Energy

There are lots of possibilities for utilization of the wind energy in Afghanistan. Most of the desert areas in the country have a lot of windy days as well as some of the mountain regions. For example, the province of Herat has at least 120 windy days per year. The winds blow from the North West and their direction is to Herat, Siestan and Helmand, forming a wind arc.

The speed and direction of the winds in the provinces are, however, not well investigated as yet. This investigation should be one of the first aims of meteorological authorities. Afghanistan has large potential of the wind energy. Another aspect requiring urgent action is the development of a cheap and appropriate design of wind mill.

vi) Solar Energy

The utilization of the solar energy in the country is limited to the traditional and primitive ways of implementation. There are no modern techniques for utilization of the solar energy in the country.

Afghanistan has an average of not less than 250 sunny days per year. The extensive utilization of this energy is very much possible.

It is one of the subjects on which UN assistance is required.

vii) Hydro-power

Several promising sites have been identified for hydro-power development, which is the biggest potential source of renewable energy in Afghanistan. Only 360 MW has yet been developed out of 23,000 MW potential. Multi-purpose use of the reservoirs for irrigation and power will be most beneficial to the nation. Availability of hydro-power is a function of water availability and the height through which it can be dropped. Due to mountainous configuration and steep slopes of some rivers, good drops in ground are in abundance but 60 to 70% of the annual run-off occurs as snow melt from Hindu Kush during a 4 month period. This necessitates large storage reservoir and extensive hydrological investigations. Hydro-power schemes, requiring large reservoirs would no doubt be expensive, requiring long construction periods. It can take 10-12 years to complete a project from the stage of reconnaissance study.

Technical and financial help is needed to prepare feasibility studies, detailed designs and take up construction.

iii) Micro-Hydel

As mentioned earlier, economic condition can only be improved, if development reaches the rural area where about 80% of the population resides. In spite of the hydro-power potential of the country being about 23,000 MW, all villages cannot benefit from major power plants due to remote locations, to which transmission lines would be very costly. Micro-hydel schemes, for which there are plenty of sites in Afghanistan, thus need to be surveyed and taken up.

Technical and financial assistance is required for investigation designs and construction of the micro-hydel schemes.

Non-Renewable Energy Sources

i) Gas Energy

Afghanistan has considerable deposits of natural gas in the country. The present production is about 2.6 billion m³ per year and there is scope for considerable increase in its production. Even at this rate of production, the easily accessible reserves are expected to have a life expectancy of 50 years. Subject to acceptable pricing, natural gas could be used as a fuel source for thermal power generation.

The potential for power generation, using natural gas depends on the future policy adopted for gas exports. In the socio-economic development plans, provisions are made for increase in power generation utilizing natural gas. Additional 12 MW thermal unit in Mazar-i-Sharif and a new gas turbine station in Kabul with capacity of 44 MW are to be built. Besides being exported, natural gas is also used for production of fertilizer as well as other domestic needs. The present production of power for gas is about 36 MW.

ii) Oil Energy

Domestic oil production is insignificant as compared to the needs. All the petroleum products used in Afghanistan at the present time are imported. The domestic oil production situation will change with the development of the Angot field and the implementation of plants to build a small oil refinery at Shibergen (North part of Afghanistan). If the refinery is equipped with vacuum distillation facilities, it would yield greater quantities of the lighter, more valuable fractions such as gasoline and diesel oil. In that case the residual oil quantity would be reduced.

Imported fuels in the form of petroleum products represent a very large percentage of the total energy consumed in Afghanistan. Approximately 175,000 tonnes of the imports are diesel or distillate fuel, the product most likely to be used for gas turbine or diesel-driven generator units. The only category of oil considered to be economically suitable for large-scale power generation is the residu that will become available from the planned refinery beginning in late 1962 (1983). Diesel and distillate fuels for new generation will have to be obtained by increasing the quantities imported. Refinery residual oil may find little market in Afghanistan if it is not used as fuel.

iii) Coal Energy

The coal now being produced is ranked as medium to high bituminous value. The majority of run-of-mine coals have a high ash content of from 20 to 30%, low inherent moisture, and calorific values that range from about 5,200 to 7,000 Kcal/kg. The known coal deposits require underground mining and there is very little likelihood of open pit exploitation.

The existing coal mines, or known reserves at four locations merit consideration as possible sources of fuel for thermal power generation. It has already been mentioned, that there is no coal operated thermal power station in Afghanistan.

The coal deposit locations are in Northern and Western parts of the country.

Pul-i-Khumri District

Two mines are located in the area, Karkar and Dudraash. Total reserves of these mines are about one million tonnes.

Iskpushta District

The mines in the area of Iskpushta, Gulasing and Kilich, have a total deposits of 9.5 million tonnes.

Der-i-Suf District

There are two coal mines in the district. Dahan-i-Toor located 145 KM Southwest of Semangan or 170 KM South of Mazar-i-Sharif. Sabzak is 45 KM Southeast of Der-i-Suf. Total coal reserves are about 80 million tonnes.

Herat District

The coal mine of Sabzak area, about 110 KM North-east of Herat, have a coal deposit of 9 million tonnes.

Existing coal mines in Afghanistan are operated under relatively primitive conditions and low rates of production, which are not suited to the needs of power generation. As such, present production costs are

not a good indication of the probable future costs. There is a large degree of uncertainty in estimates of total reserves and of unit cost for coal as fuel.

Extensive survey of the coal mines, and evaluation of economic production methods are urgently needed for which technical financial assistance is required.

5. Constraints in the Utilisation of New and Renewable Sources of Energy and the Assistance Needed

The main constraints standing in the way of development of new and renewable energy are both financial and technical. A country like Afghanistan, which is land-locked and least developed can hardly afford to set aside funds for research and investigations where needs of other essential items are difficult to meet. We are thus left far behind and to catch up with other countries where considerable progress has been made on new and renewable energy, we need immediate assistance.

Broadly speaking, we need assistance on the following items:

- 1) Setting up of 6 regional research and investigation centres, one of which to act as central co-ordinating unit for the others.

Two of these centres in western region will deal with wind energy and four centres in North, South, East and West with Solar Energy.

- 2) 2 of the research centres to deal with research and investigation of biogas and biomass sources of energy.

- 3) An organisation to collect all basic data for development of new and renewable sources of energy.
- 4) Facilities for transfer of technology, to Afghanistan, the knowledge gained in other countries.
- 5) Setting up of a central organisation for investigation of micro-hydel schemes, reconnaissance surveys, feasibility studies, designs and construction supervision.
- 6) Facilities for investigation for geothermal energy.
- 7) Surveys of existing forests and evaluation of existing stock of commercial and other types of timber and fuelwood, and programme for exploitation.
- 8) Afforestation programme, forest conservation legislation, development of social forestry etc. Study of suitable and quick growing plant species.
- 9) Research on the design of efficient wood burners for cooking.
- 10) Introduction of modern and efficient techniques on coal mining.
- 11) Improved techniques for manufacture of charcoal and use of appropriate technology suitable for Afghanistan.
- 12) Investigation of hydro-power, reconnaissance surveys, feasibility studies, designs and construction supervision etc.