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THE OUTLOOK FOR DEVELOPMENT OF RENEWABLE ENERGY IN UZBEKISTAN

Uzbekistan

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Foreword

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The progress of civilization on Earth has always been closely linked to the type and amount of energy consumed. At present, the volumes of energy consumption have reached a level which, if allowed to grow further, would impact the biosphere and hinder the future development of humanity.

Because of this potential impact, countries around the world began paying attention to the use of non-polluting renewable energy sources during the last decades of the 20th century. Solar and wind energy sources have been of particular interest in this regard. An example of this can be seen in the growth rate of wind energy production. The present growth rate for wind energy production is only little lower than that of information technologies.

Our sunny Uzbekistan has just started developing a strategy to introduce renewable energy sources. Though the current costs related to renewable power technologies essentially exceed the costs of traditional energy technologies, it is already possible to foresee obvious areas for their introduction. For Uzbekistan it is primarily electric power plants and heat plants at low-capacity local industrial facilities and building sector facilities; the agricultural and social sector and farms and greenhouse facilities, etc. Currently, the use of renewable energy sources in the distant and hard-to-reach areas located in mountain, desert zones, and remote pastures, is quite competitive in relation to the traditional sources of energy.

This publication was prepared by UNDP in Uzbekistan to provide a comprehensive review of modern energy utilization in the country and opportunities for using renewable energy sources, not only from technical point of view, but more importantly, their economic and social implications. The authors of the publication have attempted to encompass all aspects of this problem in simple language, which will hopefully spark interest not only among experts, but also in a broader audience. In turn, this will create a basis for better efficiency and energy safety for the country.

Galina Saidova

Foreword

UNDP Resident Representative and UN Resident Coordinator

Uzbekistan has substantial potential in terms of renewable energy, which exceeds the current annual volumes of production of fossil fuels by a factor of three. Solar energy is the most promising renewable technology for Uzbekistan as it is accessible nationwide for many days of the year. Increasing use of solar energy in Uzbekistan can make more gas available for export while meeting the national demand for electricity and heating, especially at remote locations.

Electricity supply in Uzbekistan faces challenges – particularly, in the rural areas where 60 percent of the population live. The modernization and rationalization of power stations, transmission and distribution networks are priorities for national industrial development as well as for the improving living standards of the citizens. The development of renewable energy would free many remote locations from grid connectivity, ensuring reliable supplies while also reducing the significant transmission losses. Currently, the only renewable with some share in the energy balance of Uzbekistan is hydropower. Despite their potential, the other renewables presently make an insignificant contribution.

Along with economic development, we must think of preserving our natural resources and preventing environmental degradation. More and more effort is being expended to develop applications for new energy technologies and to use fuel and energy more efficiently. But what will make the greatest impact is the introduction of increasing amounts of renewables into the energy production mix.

So far, awareness about renewables in the country is limited and there is a shortage expertise regarding scientific and engineering aspects of solar and wind energy. This is a situation common to many developing countries, which need to follow the accelerating technological developments for the renewables, as well as set up the proper economic environment that will foster private sector involvement to deliver more solar and wind energy to the national energy mix. Among the measures to take are setting fuel and energy prices for the traditional sources that reflect as close to true cost as possible, promoting energy-efficient devices, and educating the population to conserve energy.

The purpose of this publication is to increase the awareness of the decision makers, academic circles and the general public to the potential of the renewable energy options for Uzbekistan. It tries to dispel the impression that renewables are only for rich countries or that renewable energy is economically unfeasible and promoted simply for environmental considerations. In fact, transition countries, where the energy infrastructure is being renewed to support economic revival, provide a better opportunity for introducing renewables since the aged energy infrastructure has become increasingly expensive to maintain the decades-old conventional technology.

Fikret Akcura

LIST OF ABBREVIATIONS

ADB	Asian Development Bank
CDM	Clean Development Mechanism
DANIDA	Danish International Development Agency
EU	European Union
GEF	Global Environment Facility
HPP	Hydro Power Plant
IPP	Independent Power Producer
LPG	Liquefied Petroleum Gas
PVS	Photovoltaic Systems
RE	Renewable Energy
RES	Renewable Energy Sources
R&D	Research and Development
SHP	Small Hydro Power
TACIS	Technical Assistance to Commonwealth of Independent Countries
t.c.e.	Ton of Coal Equivalent
t.o.e.	Ton of Oil Equivalent
UN	United Nations
UN FCCC	United Nations Framework Convention on Climate Change
UNDP	United Nations Development Program
VAT	Value Added Tax

Units

cal	calorie
cub. m	cubic meter
J	Joule
km	kilometer
kVA	kilo Volt Ampere
m	meter
s	second
sq. m	square meter
V	Volt
W	Watt
kWh	kilowatt-hour

Prefixes and multipliers

Prefix	Symbol	Multiplier	Base 10 notation
Tera	T	Trillion	10^{12}
Giga	G	Billion	10^{9}
Mega	M	Million	10^{6}
Kilo	k	Thousand	10^{3}

Equivalent units of measurement

1 t.o.e. = 10 Gcal = 41.86 GJ =11. 63 MW = 1.43 t.c.e.

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The singularly important role energy plays in human lives, and in society as a whole, has made it possible to increase many times over the possibilities for satisfying various human and social needs. The progress of human civilization has always been closely associated with the amount and types of energy utilized.

The energy intensity of economic development has increased so much during the 20th century, and especially the last 40 years, that its effects on the global environment have become noticeable. The global warming is closely linked to the gases emitted by the thermal power plants using fossil fuels, as well as the exhaust gases from the ever growing number of internal combustion engines. In the last 40 years, more fossil fuels have been extracted than throughout the rest of the entire history of the human race, and the appetite of the world is not likely to abate during this century. The current world demand for fuel is on the order of 12 billion tons of oil equivalent (t.o.e.) per year (roughly 2 t.o.e. per person, globally) [1]. The demand is expected to continue to grow.

Fossil fuels – petroleum, natural gas, uranium and coal – are the mainstay of the world's energy supplies and shall continue to be for the foreseeable future, although the new reserves are always at more remote locations and less easy to extract. Given current levels of consumption, known reserves of petroleum are expected to last another 45-50 years, natural gas another 70-75, coal another 165-170, lignite another 450-500, and nuclear fuel for many years [1, 2, 3].

The geographical distribution of reserves of fossil fuels is uneven and the geological conditions of those reserves vary greatly. As a result, supplies are concentrated in a small number of countries which are not necessarily the major consumers, leading to supply-demand frictions. Beyond that much harm is done to the environment by the extraction, refining, transport and utilization of fossil fuels.

Further economic development and population growth will inevitably increase energy production, use of fossil fuels and the attending environmental impact. The more environmentally-friendly energy technologies have yet to make any significant impact on that picture.

Hydropower potential of rivers, reservoirs and irrigation canals; solar energy; wind energy; biomass energy (including energy from household wastes); tidal energy and energy from ocean waves; and geothermal energy constitute the range of alternative energy options. Renewable sources of energy are theoretically very desirable but the costs associated with them and the conditions in which they produce energy make their use less attractive. Unless the considerations of global warming compel, they are likely to remain marginal in the short term.

Usually, renewables are not able to provide a continuous or large amount of energy that would meet the needs of any sizeable community or industrial plant. Hence, they are either small in scale, suited to isolated application, or must be supplemented by the customary energy sources. Solar panels and wind farms of any size for electricity production have to be well designed to minimize their unfavorable effects on the immediate vicinity of their location. Hydrogen energy may prove quite polluting, if the broader production process of hydrogen is factored in.

While nuclear energy is seen as a short-term solution against greenhouse gas emissions, one has to remember the radioactive byproducts which have harmful effects for thousands of years and have to be kept isolated. When those are considered, the high cost of nuclear energy fully emerges.

Of course, the best help to preserving our natural resources and preventing environmental degradation is through efficient production and use of energy. More and more effort is being expended to develop applications for new energy technologies (combined heat and power production, fuel cells, coal gasification, and various types of liquid synthetic fuel), to use fuel and energy more efficiently, and to introduce

increasing amounts of renewables into the energy production mix. Demand-side attention is also important. We must use energy more carefully so that we do not have to produce it unnecessarily, depleting precious resources and adding to environmental degradation. That requires setting energy prices that reflect as close to true cost as possible, produce energy-efficient devices, and educate the population to conserve energy.

Another benefit of renewables is that they allow hydrocarbon resources to be more useful as the raw materials for the petrochemicals industry rather than simply been burned away to generate electricity. Renewable energy can potentially become the only economically feasible, accessible and reliable source of energy for remote settlements.

At the same time, renewable energy does have some disadvantages: variability in time, low energy flow density, and high unit cost. Hence, renewable energy has been encouraged through government incentives. Whereas the subsidies on renewables are quite clear, the many subsidies on the conventional fuels and power generation technologies are hidden and a direct comparison therefore can be quite misleading. It is likely, if the whole chain of energy production is systematically subjected to an economic analysis, that renewables would emerge as not more expensive than the conventional ones. Considering that the renewables technology has much development potential and that economies of scale are yet to be reflected in any measure, the potential for renewables in a true market economy may not be as unfavorable as currently portrayed.

In Uzbekistan, a transition economy whose energy market is pretty far from reflecting true market behavior, it is much more important that the potential of renewables be investigated properly in order to determine their true potential for the country's future. Renewable energy, like any other new technology, is in need of certain government support schemes for its adoption and development. It has been the experience of countries which make significant use of those technologies that government support schemes can be political and legislative in addition to purely economic. The greater part of such support schemes practiced around the world can be introduced in Uzbekistan in stages.

In order to put the renewables within context and decide on the support schemes, first of all, Uzbekistan needs to formulate its overall Energy Strategy, and then place the renewables within that before considering how, and to what extent, it will support renewable energy technologies, and to what degree domestic development versus imported technologies would be sought.

Based on material in the *UNDP Project Report on Review Studies for National Strategy on Renewable Energy in Uzbekistan*, and materials relating to a number of other international renewable energy projects, this publication is conceived primarily as a survey of the current status of energy in Uzbekistan as it relates to the outlook for using renewables in Uzbekistan.

This publication does not propose specific solutions nor does it assess the security of the energy supply of Uzbekistan and its regions, much less propose a renewables development strategy. The purpose of this publication is to make the decision makers, academic circles and the general public more aware of the potential of the renewable energy options for Uzbekistan. It tries to dispel the impression that renewables are only for rich countries or that renewable energy is economically unfeasible and promoted simply for environmental considerations. In fact, transition countries, where the energy infrastructure is being renewed to support economic revival, provide a better opportunity for introducing renewables since the aged energy infrastructure has become increasingly expensive to maintain with its decades-old conventional technology.

Chapter 1 presents an overview of the status of Uzbekistan's energy sector and its infrastructure. A general overview of renewable energy in the world is provided in Chapter 2, while Chapter 3 goes deeper into the technology of renewables. Chapter 4 provides the significant lessons drawn from the experience of the countries which have led the renewable energy field so far. The general potential for renewables in Uzbekistan and the technological dimension of developing renewable energy in Uzbekistan are covered

in Chapter 5. The economics of renewable energy in Uzbekistan is discussed in Chapter 6.

Chapter 7 looks at the enabling environment for renewables in Uzbekistan from the angles of Government patronage, legal-legislative framework, incentives and the various support schemes.

The Conclusion summarizes the main recommendations, based on the contents of this publication.

Statistical data and other quantitative indicators cited in this publication are taken from commonly available publications.

The compilers of this review wish to express their sincere gratitude to those international and national organizations which have conducted research on renewable energy in Uzbekistan and to those experts at local agencies who provided valuable comments and suggestions during the preparation of this publication.