TAJIKISTAN:

ACCELERATING PROGRESS TOWARD THE MDGS BY ACCESS TO ENERGY

TAJIKISTAN:
Accelerating Progress Toward the MDGs by Improving Access to Energy

Dushanbe 2010

United Nations Development Programme, UNDP

Design:
Phoenix Design Aid A/S, Denmark. ISO 14001/ISO 9000, certified and approved as a carbon neutral company.

Cover photo caption:
Ishkashim, Pamirs. 22 July 2010. People living in villages stocking hay.

Cover photo credits:
Mikhail Romanyuk, Tajikistan

TAJIKISTAN:

ACCELERATING PROGRESS TOWARD THE MDGS BY ACCESS TO ENERGY

FEBRUARY 2012

FOREWORD

Tajikistan, like many countries around the world, is making serious efforts to achieve the Millennium Development Goals (MDGs) by the year 2015.

Information on progress toward the MDGs in Tajikistan shows that, if the appropriate conditions to accelerate the progress are created, the targets can be achieved. An analysis of the pace of addressing the challenges shows that, in some areas, much progress was made and Tajikistan is on track to achieve several goals. However, many goals and targets are currently off track. In addition, compound crises of recent years, most of which originated outside Tajikistan, threaten to significantly slow down or reverse the progress toward the MDGs. The progress to date shows that the MDGs can be reached only if additional concerted efforts are taken to accelerate the progress.

This report proposes catalytic interventions on the basis of existing commitments and demonstrates opportunities to remove bottlenecks that impede the achievement of the MDGs in the next 5 years. Specifically, the key intervention proposed is expansion of access to energy, which has the potential in a relatively short period of time to have a decisive impact on accelerating achievement of MDG 1 (Eradicate extreme poverty and hunger) and simultaneously create a favorable environment for reaching other goals.

The United Nations Development Programme (UNDP) has been advocating for the development of small-scale energy in Tajikistan, as it has the greatest potential to reduce poverty and achieve other MDGs. In this document, we argue that the development of small-scale energy, which would require focus and the concentration of efforts and resources, is the key factor that can unlock Tajikistan's potential for inclusive development.

Ms. Zahira Virani
Country Director a.i
United Nations Development Programme in Tajikistan

TABLE OF CONTENTS

LIST OF TABLES

LIST OF BOXES

ABBREVIATIONS AND ACRONYMS

AS	Academy of Sciences
CPAP	Country Programme Action Plan
CO2	Carbon Dioxide
CRURES	The Center for Research and Use of Renewable Energy Sources
DFID	UK Department for International Development
GBAO	Gorno-Badakhshan Autonomous Oblast
GDP	Gross Domestic Product
GTZ	German Technical Cooperation
GUP	State Unitary Enterprise
HIV / AIDS	Human immunodeficiency virus/Acquired immunodeficiency syndrome
IDUs	Injecting Drug Users
HPP	Hydro Power Plant
kWt	kilowatt
MAF	Millennium Development Goals (MDG) Acceleration Framework
Majlisi Namoyandagon	House of Representatives (Lower House of Parliament)
Majlisi Oli	National Parliament (Upper House of Parliament)
MDGs	Millennium Development Goals
MEDT	Ministry of Economic Development and Trade
MEI	Ministry of Energy and Industry
MLSP	Ministry of Labor and Social Protection
MoE	Ministry of Education
MoH	Ministry of Health
MSDSP	Mountain Societies Development Support Programme
NDS	National Development Strategy
NGOs	Non-governmental Organizations
PPP	Purchasing Power Parity
PRC	People Republic of China
PRSP	Poverty Reduction Strategy Paper
RES	Renewable Energy Sources
RT	Republic of Tajikistan
UN	United Nations
UNDP	United Nations Development Programme
UTPPs	Urban thermo power plants

ACKNOWLEDGMENTS

This report was prepared by Hojimuhammad Umarov, Rafika Musaeva, national consultants, Mubin Rustamov, UNDP Tajikistan Programme Analyst and Slavica Robic, International Consultant, UNDP Tajikistan Energy and Environment Programme. This work was steered by Rastislav Vrbensky, UNDP Tajikistan Country Director and overseen by Sukhrob Khoshmukhamedov, Assistant Resident Representative/Programme of UNDP Tajikistan.

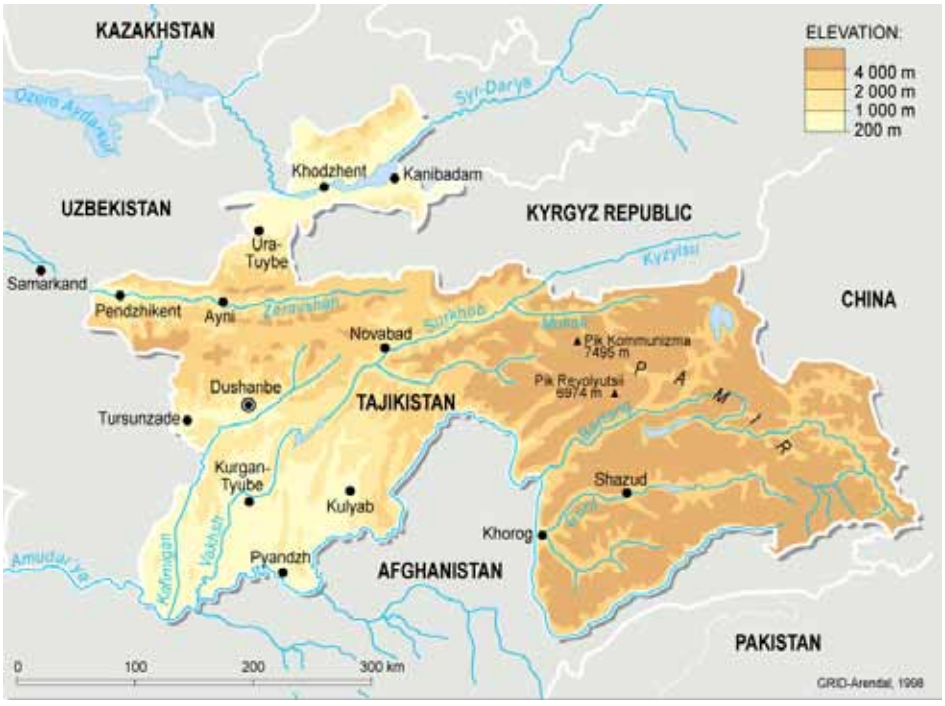
We would like to express appreciation to Tuya Altangerel and Uyanga Gankhuyag, UNDP Poverty Group/ Bureau for Development Policy for their valuable advice, substantive comments and editing of the report. We also thank Vladimir Mikhalev, UNDP Regional Centre in Bratislava, for his guidance, as well as Shantanu Mukherjee, Renata Rubian, Daniela Gregr and Gonzalo Pizarro, UNDP Poverty Group/ Bureau for Development Policy in New York.

Preparation of this report would not have been possible without many individuals from the various parts of the Government of Tajikistan who provided their advice and materials used for the analysis in this report: U. Ziyodaliev, Head of the Department, Ministry of Labor and Social Protection; B. Aliev, Head of the Department, State Committee on Investment and State Property Management; Alim Nasimov, T. Valamat-Zade, J. Samiev and M.Burkhonova, Ministry of Energy and Industry; F. Salomov, Z. Yakubova, M. Usmonov, Ministry of Economic Development and Trade; O. Mavllonov, Ministry of Health; D. Kimsanov, Ministry of Melioration and Water Resources; A. Alimatov, Ministry of Education; T. Tagoymurod, Chairman of GUP Galla (State Unitary Enterprise on Wheat Production) have provided valuable inputs.

We thank Zoran Morvaj, International Consultant, Mirzohaydar Isoev, Programme Analyst, UNDP Tajikistan Energy and Environment Programme, Farrukh Shoimardonov, Renewable Energy Sources (RES) Governance Advisor, UNDP Tajikistan Energy and Environment Programme and Nargis Djuraeva, UNDP Tajikistan Programme Associate for their timely support and coordination.

We also thank Barbara Hall for editing the report, Valeria Trupanova for translating the report into Russian and English and Mikhail Romanyuk for the photographs.

MAP OF TAJIKISTAN



EXECUTIVE SUMMARY

Energy situation in Tajikistan

In the past three years, Tajikistan has experienced a severe energy crisis compounded by the global food, fuel and economic crises. These crises threaten to reverse the progress that the country made in the past decade to achieve the MDGs.

About 60 percent of Tajikistan's energy is supplied by a large hydropower station on the Vakhsh River, the water level of which is steadily declining. Deterioration of energy infrastructure and underinvestment are creating energy shortages throughout the country. The severe winter of 2008 brought these energy problems to the fore. Although the period of acute crisis has now ended, the entire country, and especially rural areas, is still suffering from electricity shortages; indeed, even areas that have physical access to electricity often have cutoffs.

Energy access as a foundation for MDGs

In any country, energy access is a fundamental prerequisite for reaching the MDGs. In Tajikistan, it is even more important, as it also enables access to water drawn by electric pumps, because many towns and settlements located at high altitudes. Thus, Tajikistan needs not only to bring its energy supply back to pre-crisis levels, but also to expand it in rural areas, where 75 percent of the population lives.

Better energy access will improve health outcomes. Absence of electricity leads to poor heating and increases vulnerability to illnesses, especially among children. Increasingly, due to the lack or unreliable sources of energy, health centres are less able to adequately store vaccines and essential medicines, and sanitize their facilities. Many are closing down or operating only a few hours a day. It is apprehended that there is a growing tendency of home births, which could negatively impact maternal and child health.

Improving energy access will also help increase education outcomes. With only a few hours of lighting a day and poor heating, children are spending less time studying. Absenteeism in schools, kindergartens and higher education institutions is increasing, while teachers are less able to use modern technologies such as computers, visual displays and labs.

Energy access – or the absence of it – has profound implications on the lives of women and girls. As primary caretakers of their families' food needs, women and girls are spending more time collecting fuel and water and less time for other activities.

As residents cut trees and shrubs to fire their stoves, the forest cover shrinks. Deforestation leads to desertification and reduces the absorption of carbon dioxide from the atmosphere. Denudation of mountain slopes erodes soil and increases the risk of landslides. The recent mudslide in the town of Kulyab, which claimed many lives, is evidence of the disastrous effects of the energy crisis.

The lack of energy especially affects the poor. They have to pay more to meet their basic needs

for electricity, heating and water. The decline in agriculture and other industries due to energy shortages further reduces income-earning opportunities and increases poverty.

With the agricultural and industrial sectors consuming 80 percent of domestic energy, the decline in energy supply directly translates into a reduction in economic activity and, consequently, incomes.

Small-scale energy development

Tajikistan has prioritized construction of large hydropower stations similar to those on the Vakhsh River, but there is a growing recognition that small-scale energy is a better option for improving energy access.

Tajikistan has rich hydropower potential: it holds 4 percent of the world's hydropower resources. Moreover, these resources are spread throughout the country through countless rivers and streams. It also has good potential for the development of wind, solar, biomass and geothermal energy. With 93 percent of its territory mountainous, Tajikistan is more suited for constructing small-scale renewable energy sources, rather than building extensive energy grids.

Small-scale hydropower stations can be constructed quickly and with modest financing. Already, many communities in rural towns and villages have taken the initiative to build small-scale hydropower stations by mobilizing their own resources. Most funds come from remittances sent by Tajik migrants from abroad. Also, several hydropower stations of varying sizes – micro, small and medium – have been built with financing from development partners, financial institutions and the government budget.

Bottlenecks to small-scale energy

Although small-scale energy development is feasible, several bottlenecks prevent the transformation of this vision into reality.

First, the government needs to adopt a series of legal and regulatory changes to facilitate the sector development.

Second, detailed and systematic studies are required to assess the actual and potential hydropower resources, as well as to estimate the impact of the development of these resources region by region. The last official, detailed research of energy resources in Tajikistan was conducted in the 1950s.

Third, although many initiatives to construct small-scale energy stations are springing up, the majority of them are too small in scale. Most hydropower stations erected in recent years have a capacity of up to 10 kWt, which is only enough to power a few houses. Community resources are usually not sufficient to finance larger projects. Such projects need to be driven by public-private partnerships and financing.

For small-scale energy to become a daily reality in Tajikistan, these and many other obstacles need to be addressed.

Financing cleaner energy

The world is locked in a dependency on depletable fossil fuels. The economies of scale and technologies available currently make energy from fossil fuels cheaper than renewable energy. Thus, the development of renewable energy requires concerted support through public and public investments and reforms.

Due to its rich renewable energy resources, Tajikistan offers an ideal platform to research, develop and use affordable, small-scale renewable energy technologies. The experiences in Tajikistan can then be replicated in other developing countries, helping them to get on track toward low-carbon development.

Public investment from domestic resources and especially the Official Development Assistance (ODA) will play an important role in unlocking Tajikistan's renewable energy potential. Improving energy access through small-scale energy development will not only address the energy crisis, but also help Tajikistan achieve its MDGs.

Developing an action plan

Building on consultations with government officials, experts inside and outside the energy sector, local communities, private sector, and academics, UNDP has helped develop an Action Plan that focuses on small-scale energy development. This Action Plan was developed using the MDG Acceleration Framework, a methodology that breaks down the overall problem into distinct bottlenecks and solutions to overcome those bottlenecks (see Table 6). Following this methodology, the Action Plan builds on prior initiatives of the government and development partners and is informed by existing local experiences and public-private partnerships to construct small-scale hydropower stations. Importantly, by explicitly linking energy access to MDGs, the Framework provides a holistic approach that combines the social and environmental benefits of renewable energy development with financial and technical considerations in order to strengthen the case for financing. The Action Plan will help operationalize the National Programme and the Law on Renewable Energy.

INTRODUCTION

At the global MDG Summit held in September, 2010, world leaders reviewed the progress made toward achieving the MDGs at the global, regional and country levels. The Summit also paid special attention to determining future development prospects and to accelerating the progress toward the MDGs by 2015. Achievement of these goals will help humanity overcome extreme poverty; achieve universal education; reduce child and maternal mortality; reduce disparities between women and men at all levels of education; enable their participation in public life; ensure that they can use health services and opportunities provided by modern civilization; protect women and men from life-threatening infectious diseases; improve environmental sustainability; and provide access to clean water and clean energy.

Existing trends show that, despite serious difficulties and challenges, Tajikistan has the potential to achieve the MDGs by 2015. However, progress will not happen by inertia, with current trends unchanged and with obstacles persisting and, in some cases, even worsening.

In recent years, Tajikistan has come under pressure from external and internal factors. The detrimental impact of the global financial crisis on the socio-economic development of the country is of particular concern. The crisis drastically reduced growth rates from 7 percent in 2008 to 3.9 percent in 2009, reduced external remittances of migrant workers from US 2.6 to US1.6 billion, and reduced foreign direct investment and humanitarian assistance. Additional oil export taxes introduced by Russia raised the prices of petroleum products, while severe droughts in Russia and Kazakhstan increased the prices of grain and flour, which form an important part of the staple diet in Tajikistan. The situation in the capital and consumer goods markets has further worsened as a result of Uzbekistan's unilateral embargo of transit goods to and from Tajikistan.

No less important was the effect of natural disasters that, intensified by the effects of climate change, have become more frequent in recent years. Natural disasters in Tajikistan in 2010 incurred material losses that far exceeded foreign aid inflows in the same year. As a result, the country is unable to fully implement rehabilitation efforts. These developments have slowed down the process of achieve many of the MDG targets.

In many countries that aim to achieve the MDGs, some progress has been made in recent years. In Tajikistan, these achievements are recorded in the MDG progress reports, prepared in 2003, 2005 and 2010. The new challenges – the energy and food crises, deterioration of relations with neighbouring countries and the subsequent blockage of the main transportation routes, as well as the world financial and economic crises – were envisaged neither in the baseline document of 2000 that set the MDGs for Tajikistan nor in a more recent report, Tajikistan: Investing in Sustainable Development: MDG Needs Assessment (2005).

This report Tajikistan: Accelerating Progress toward the MDGs by Improving Access to Energy builds on the 2010 MDG Report that documents the progress toward the MDGs in Tajikistan. It highlights interventions to expand energy access required for the achievement of the MDGs by 2015. It identifies the reasons for bottlenecks to achieving targets and goals, identifies solutions, and quantifies the costs to implement these solutions. This report uses an original approach, the essence of which lies in determining a catalytic set of interventions, which help impact selected off track MDGs.

In the specific circumstances of Tajikistan, the fundamental challenge to accelerating the progress to MDGs is the lack of access to electricity. It strongly hampers achievement not only of Goal 1 (to eradicate extreme poverty and hunger), but also of many of the other goals. The deficit of electricity is felt in daily life, in economic activities and in the social sphere. Increasing the energy supply for the population and the economy to levels commensurate with the current stage of development can not only ensure the normal functioning of the population and the economy, but also improve indicators of the quality of life (such as education, health, culture and social welfare).

The key to solving the energy access problem can be found in rapidly developing small-scale energy sources. They are particularly important in rural Tajikistan and especially in the mountainous regions, which face extreme challenges to achieving the MDGs.

The need to develop a strategy and an action plan on accelerating progress toward the MDGs was raised in the process of consultations on the draft and final versions of the report on MDGs in Tajikistan in 2010, where various public and private institutions and international and regional financial and economic organizations were involved. The final version of the MDG report was presented at a seminar held at the Ministry of Economic Development and Trade of the Republic of Tajikistan. During these consultations, participants expressed the need to accelerate the development of small-scale power generation, particularly through small-scale hydropower, as the most effective way to accelerate eradication of extreme poverty and destitution and to help achieve other targets.

This analysis of how to accelerate progress toward the MDGs in Tajikistan will thus be particularly important for this purpose, drawing the attention of partners, especially international donors and private sector representatives, to identify and implement interventions needed to fully achieve the MDGs by 2015.

SECTION 1.

Progress and Challenges in **Achieving MDGs**

Dushanbe, Shohmansur ('Zeleniy') Market. 25 Feb, 2007. 'Arobakash'-boys waiting for customers.

Ten years ago, at the time of signing the UN Millennium Declaration, Tajikistan faced formidable challenges. Many of them have been resolved over the past decade, yet some still remain unresolved. In addition, Tajikistan has been hit in recent years by compound crises that threaten to derail progress toward the MDGs: the global financial and economic crises, food and energy crises, and external factors negatively affecting the transit of goods to Tajikistan.

The country needs additional, catalytic interventions to ensure timely achievement of the MDGs. Before determining the key areas for such cooperation and support, it is necessary to assess the progress made to achieve each goal. This section summarizes that progress.

For MDG 1, progress looks satisfactory. The annual rate of decline in overall poverty was 3.3 percent and, by 2015, Tajikistan will most likely succeed in bringing the poverty rate below the target of 41 percent; this also applies to extreme poverty rates. Nevertheless, trends in the composition and quality of food consumption are changing very slowly. According to the World Food Programme, the caloric intake in Tajikistan is so low that food consumption is characterized as 'the consumption of the poor'. It is hardly possible to radically change this situation by 2015.

On the positive side, the unemployment rate is now 3.5 times lower than in 2000. The decrease in unemployment was due to an increase in labor migration, which is increasingly becoming an important source of growth in household income. After some decline in remittances from migrant workers in 2009, they have increased again, reaching over US$2 billion in 2010.

The situation in education (MDG 2) remains critical. Public spending on education accounts for 4.1 percent of GDP and 14.0 percent of total government expenditure, which is much lower compared to 1991. Only 66 percent of boys and 15 percent of girls continue their studies after completing basic school (nine years) to receive general secondary education (including primary vocational education). According to experts' estimates, indicators of the quality of education and full coverage of boys and girls by secondary education are unlikely to be reached by 2015.

As for MDG 3, the majority of targets to ensure gender equality will not be achieved over the next five years under the 'business as usual' scenario. Moreover, some indicators, such as the ratio of girls to boys in secondary education and the proportion of women in both houses of the national legislature, have deteriorated between 2000 and 2008.

Preliminary analysis shows that progress toward MDG 4 (reduce child mortality) is unlikely to reach the planned targets. For the last 20 years, the child mortality rate has fallen only by half and the infant mortality rate has declined by even less. In the remaining five years, if no additional measures are taken, the achievement of these planned targets is unlikely.

In terms of maternal mortality (MDG 5), the situation appears positive at first sight. By 2009, the maternal mortality rate was halved compared to the early 1990s. But this development should be considered in light of the increasing share of home childbirths, which makes the total number of maternal deaths less certain. This situation makes the achievement of a reduction in maternal mortality by two thirds very unlikely in the coming five years.

Similar trends can be observed in the area of control of diseases such as HIV/AIDS, malaria and other infectious diseases (MDG 6). Within just 10 years, the rate of HIV/AIDS and tuberculosis (per 100,000 people) has grown 149.8 times and 2.1 times, respectively. A rapid reduction of HIV/AIDS cases has become feasible due to multifold increase in the scope of HIV testing, the introduction of screening, and substitution therapy for IDUs. Implementation of radical measures to change the composition of food intake by increasing the proportion of meat, milk, fats and other high-protein foods can significantly reduce the incidence of tuberculosis, since tuberculosis hits the poor and undernourished people the hardest.

Clear progress has been recorded in meeting the targets related toward ensuring environmental sustainability (MDG 7). Land area covered by forests and nature protection zones are expanding. Emissions of carbon dioxide in the atmosphere have sharply declined through increased energy efficiency and a decline in industry[1] . However, such indicators as access to clean water sources and improved sanitation have either remained the same or increased only slightly. Improving the situation by 2015 seems hardly possible.

There are mixed trends in efforts to develop a global partnership for development (MDG 8). The number of fixed and mobile phones per 1,000 people has increased 12.2 times. However, external debt grew by 70 percent and crossed the threshold of sustainability. At the same time, the global financial crisis has reduced the ability of donors and international organizations to finance development initiatives. Government spending on pharmaceutical drugs per capita has decreased by 24 percent.

Progress toward MDGs 1-7 and the current status of each are shown in Table 1 below.

[1] *Energy use is measured by kg oil equivalent per US$1 GDP*

TABLE 1. Status and Trends of MDGs in Tajikistan (all figures in percent unless otherwise indicated)

MDG	Targets	Baseline	Current	2015 target
1. Eradicate extreme poverty and hunger	1.1. Percent of the population living on income below US $2.15 a day (PPP)	83.0 (1999)	46.7	41.5
	1.2. Proportion of the population consuming less than 2100 kcal per day	22.0 (1994)	21.0	Decrease
	1.3. Employment–to–population ratio	30.2 (1995)	29.4	No target
	1.4. Prevalence of stunting in children under five years of age	42 (1996)	33.1	34
2. Achieve universal primary education	2.1. Enrolment in basic education	94.3 (1989)	99.1	100
	2.2. Literacy rate in the age group of 15-24 years	99.9 (1991)	99.9	100
3. Promote gender equality and empower women	3.1. Ratio of girls to boys in primary education	93.0 (2000)	92.7	100
	3.2. Ratio of girls to boys in secondary education	86.0 (2000)	80	100
	3.3. Proportion of seats held by women in national parliament	16.5 (2000)	59.7	33.0
	3.4. Women's salary as percentage of men's	52.0 (2002)	-	100
4. Reduce child mortality	4.1. Under-five mortality rate (per 1000 live births)	127.0 (1990)	68	42.3
	4.2. Infant mortality rate (per 1000 live births)	97.0 (1990)	56.0	31.3
	4.3. Proportion of one-year-old children immunized against measles	84.0 (1990)	96.7	100
5. Improve maternal health	5.1. Maternal mortality ratio (per 100000 population)	97.7 (1992)	46.2	33,9
6. Combat HIV/AIDS malaria and other major infections	6.1 Total registered cases of HIV/AIDS	7 (2000)	2204	Not more than 2500
	6.2 Incidence of malaria (per 100, 000 population)	6103 (1995)	165	Decrease
	6.3 Incidence of tuberculosis (per 100, 000 population)	32.0 (1996)	78.7	Decrease

MDG	Targets	Baseline	Current	2015 target
7. Ensure environmental sustainability	7.1 Proportion of land area covered by forests	2.7 (1990)	3.0	Increase
	7.2 Nationally protected areas (percent of total land area)	4.2 (1995)	22.0	Increase
	7.3 Carbon dioxide emissions (tons per capita)	3.7 (1990)	-	Decrease
	7.4 Percent of population with access to improved water sources	60.0 (2000)	60.4	80.0
	7.5 Percent of population with sustainable access to improved sanitation	90.0 (2001)	99.4	n/a

Thus, the 'business as usual' approach to meet the challenges will not lead to achieving the MDGs in the next 5 years. Moreover, the progress to MDGs is threatened by food and energy insecurities, compounded by the global financial and economic crisis. In order to respond to these new threats and to accelerate progress toward the MDGs, additional interventions are necessary, which can only be done through the joint and concerted actions of all partners, both domestic and international.

SECTION 2.

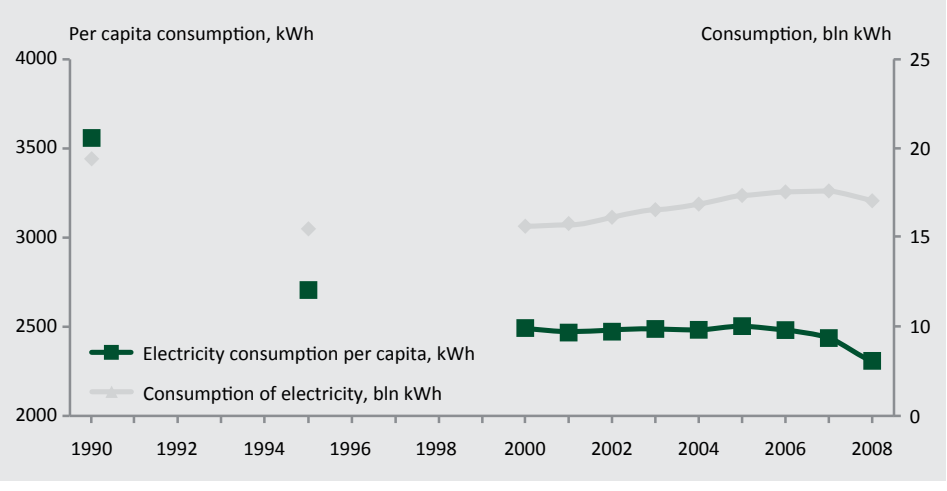
Strategic **Intervention**

Dushanbe, Rudaki ave., 17 Feb 2007. Woman and girl carrying cartons for fire. People often cook on open fire in yards, because it is cheaper and food has better taste. It is also very popular to bake in 'tandurs' - big clay ovens for which you also need wood and paper.

Energy Deficit and Its Impact on MDGs

Since 2008, Tajikistan has been experiencing a severe energy crisis that has brought to the fore the importance of access to energy as a fundamental condition to achieving the MDGs. Underlying problems – energy exchange disputes with neighbouring countries and the declining water level of the Vakhsh River, which supplies over 60 percent of Tajikistan's energy – have been exacerbated by unusually long, cold winters that have disrupted the operation of large hydropower stations since 2008. Electricity shortages have led to tight rationing. During the height of winter, electricity supply to most rural households, which had already been reduced to only six hours per day, has been cut off completely. Industries have experienced growing power cuts. Power supply in Dushanbe has been cut to 14 hours a day. The energy deficit not only disrupts social services and infrastructure, but also puts a drain on much-needed resources and creates more pressure on the environment, as rural households cut trees and shrubs to fire their stoves.

FIGURE 1 **ELECTRICITY CONSUMPTION IN TAJIKISTAN**



The underlying decline in electric consumption was exacerbated since 2008.

Source: National Statistics Committee of Tajikistan

Food shortages, electricity cuts and severe interruptions in public services prompted the United Nations Country Team to make an appeal for urgent humanitarian assistance for Tajikistan in 2008. Despite having somewhat abated, the effects of these crises remain, threatening to push the country off track to MDG progress.

Although not set as a quantifiable goal or target, access to energy is a fundamental link that influences progress toward all MDGs in Tajikistan. Heating for schools, hospitals and homes, as well as supply of water, all depend on electricity. The lack of electricity leads to a lack of water and heating, creating a vicious circle of deteriorating public services and increasing poverty.

With 93 percent of its territory mountainous, Tajikistan has a distinct geography. Many settlements in the mountains and foothills are located above the watercourses and rivers flowing in the canyons. The development of infrastructure before the transition enabled the building of water pumps powered by electricity to supply towns and villages with water from wells and rivers. This method of water provision, characteristic of Tajikistan, means that the deficit of electricity translates directly into a deficit of water.

Not only rural but also urban residents are experiencing a shortage of drinking water. About 25,000 people living in the eastern hills of Dushanbe city still remain without a regular drinking water supply. Trucks supply them with water. According to the Dushanbe Department of Water Authority (Vodokanal), the pumps are unable to supply water to urban areas located in elevated areas because of electricity shortages.

Electricity also provides water to irrigate agricultural fields. For example, in the village of Shamtuch in the Zeravshan valley in Sughd province, new land is being developed for agriculture. The village is located at the far end of the Pendjikent - Varzi - Shamtuch transmission line with a capacity of 35 kWt. Because consumers along the line use most of the electricity, water pumps cannot pump water to the height of 120 meters, where the fields are located during the seasons when they require the most water for irrigation. Consequently, newly reclaimed lands cannot provide expected crop yields.

Shortages of electricity cause irregular pumping of water and lead to the poor quality of drinking water in many urban and rural areas. Irregular water pumping leads to the stagnation of water in reservoirs, causing deterioration of its quality. In addition, people increasingly use water from aryks (irrigation ditches) that often cause infectious diseases.

Irregular supply of electricity, heating and water disrupts everyday operations of health centres and hospitals and leads to inadequate delivery of basic health services to the population. Many health centres are operating only a few hours a day or are temporarily closed. Health centres ration medical services and discharge patients who should be hospitalized. Increasingly, they cannot provide proper sanitation and adequately store vaccines and essential medicines.

The lack of electricity, heating and water also affects educational services, forcing schools and other educational institutions to disrupt classes. Teachers are not able to use teaching aids, laboratory equipment and computers. These deficits also lead to a deterioration in the minimum level of maintenance of public institutions such as orphanages and homes for the disabled and the elderly.

In Tajikistan, the agricultural and industrial sectors use 80 percent of all electricity consumed domestically. The lack of energy as well as the increased instability of the energy supply directly causes a decline in economic activity and, consequently, incomes. Lack of energy is also increasing economic losses and squeezing much-needed resources, both public and private. Without enough electricity, residents

need to build canals or irrigation ditches from the lateral gorges located uphill to draw water using gravity, which requires large investments of material resources, labour and time.

Households experiencing shortages of power cut trees and shrubs for fuel, with the burden of the work falling on women, girls and boys. Consequently, there is additional pressure on women's time, which reduces their ability to participate in economic activities and leisure time. It also leads to a deterioration of their health and generally lowers their status. It also affects school performance of children, leading to increase in the school dropout rate.

The cutting of trees and shrubs has deforested some areas, which creates conditions for desertification and reduces the capacity of the environment to absorb carbon dioxide from the atmosphere. At the same time, denudation of mountain slopes increases soil erosion and the risk of landslides. A recent disaster, a devastating mudslide in the town of Kulob, caused many casualties. It is a clear evidence of a human impact on the environment. If shrubs and forests near the town had not been cut to provide energy, this disaster could have been avoided. In addition, large amounts of traditional biomass and animal waste are used as domestic fuel instead of being used as organic fertilizer. The absence of artificial fertilizers leads to a reduction in the natural fertility of the soil and undermines the food security of the population.

It is necessary not only to reverse the deterioration in energy access, but increase energy supply from previous levels. Access to energy is a catalytic factor that would unlock the bottlenecks and accelerate progress to achieve not one, but most MDGs and targets in Tajikistan. Table 2 shows how energy access will impact achievement of Goals 1, 2, 4, 5 and 7. In addition to these Goals, it also has an impact on achievement of Goals 3 and 6, although less directly or significantly.

Renewable Energy Potential

Tajikistan has enormous renewable energy resources: water, solar and wind. It has 4 percent of the world's hydropower potential. Unlike the vast majority of mountainous countries, Tajikistan is covered by a dense network of small rivers and creeks, except for a desert plateau, Murghab, where there is a significant potential for wind energy. Settlements along the mountain rivers can get electricity from micro, mini and small hydropower plants throughout the entire year.

Tajikistan, which belongs geographically to the zone of dry subtropics, also has a significant capacity to generate solar energy. According to conducted surveys, solar energy could meet the needs of 60 to 80 percent of household needs 10 months of the year. In the highlands (Alichur Valley) and the upper part of mountain ranges, average annual wind speed reaches 5-6 m/sec, with favourable orographic factors. This makes the construction and operation of wind power plants cost-effective. In the Hissar and Rasht Valleys of Gorno-Badakshan Oblast (GBAO), there are powerful belts of geothermal waters, which have enormous potential to generate energy.

The Advantages of Small-scale, Renewable Energy Sources

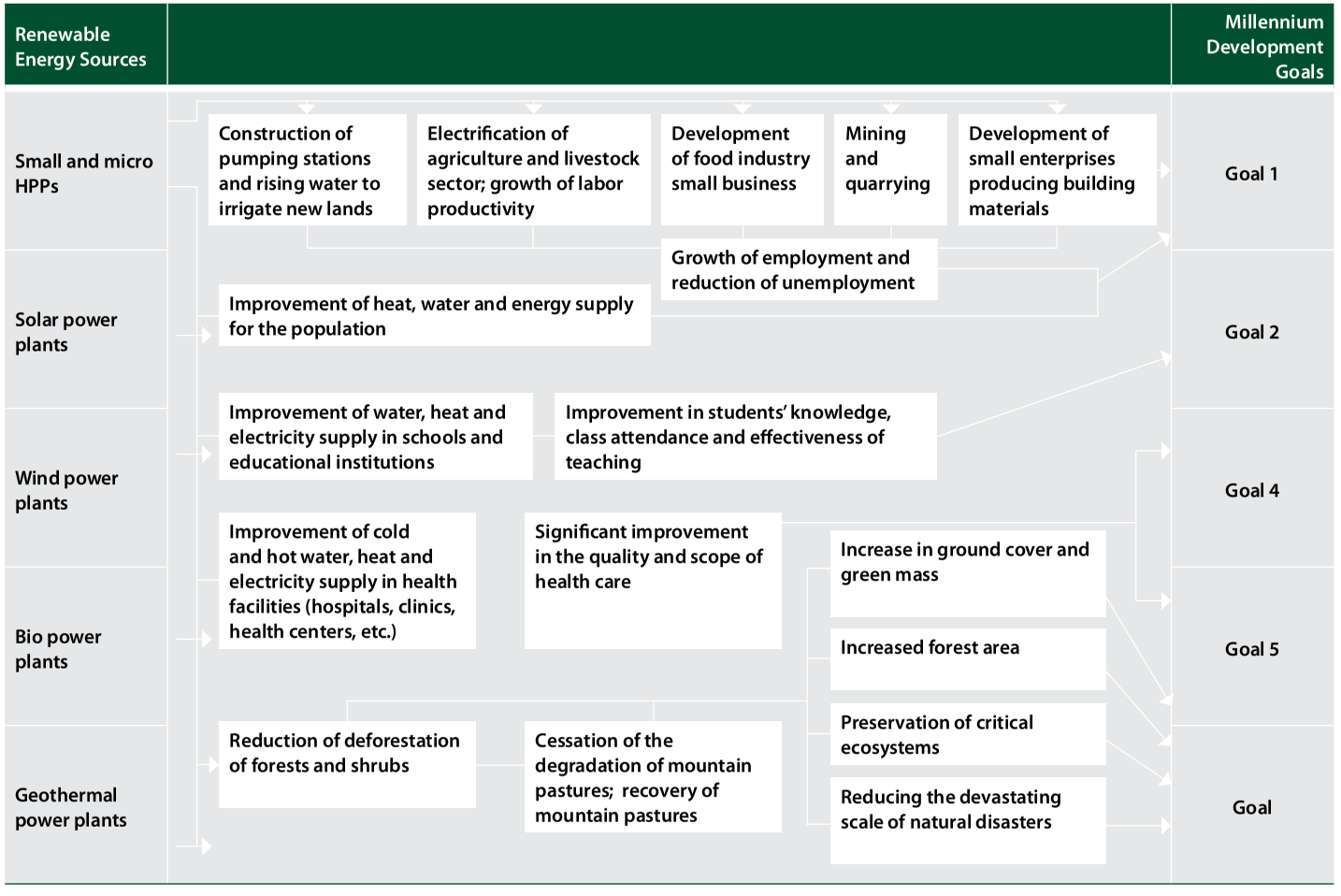
In recent years, the Government of Tajikistan has been paying increasing attention to the use of renewable energy sources through the development of small-scale power sources. This section will discuss why the growth of the country's energy supply only from major power plants is not feasible and what the advantages of small-scale energy sources are.

About 75 percent of the Tajik population lives in rural areas and 93 percent of the country is mountain-covered. The key geographical, social and economic characteristics – the remoteness of mountainous and highland settlements, the mountainous terrain that forms natural barriers between settlements, low population density, and the low quantity of energy used by enterprises, residents and public

TABLE 2. Impact of Improving Access to Energy on MDG Achievement

Millennuim Development Goals	Improving energy supply will enable the country to:
MDG 1: Eradicate extreme poverty	· Develop new land areas for agriculture at different tiers of mountain ranges and achieve food self-sufficiency of populations residing in mountain gorges and valleys · Achieve agricultural intensification and increased productivity of this sector through electrification of agricultural inputs · Develop a network of small enterprises to process agricultural products · Significantly expand the scope of non-farm employment through the creation of small and micro enterprises to use local building materials, mining and processing of decorative, ornamental and semi-precious and precious stones, the development of various kinds of handicrafts, etc. · Reduce unemployment, increase average wages and incomes of self-employed groups
MDG 2: Achieve universal primary education	· Provide the necessary amount of heating, electricity, and hot and cold water to public institutions that provide education, health, cultural and social protection services · Improve students' knowledge and school performance, as they will be able to spend more time studying, and increase school attendance · Increase the use of mobile phones, the Internet and other communication resources
MDG 4: Reduce child mortality	· Supply the necessary amount of heating, electricity, and cold and hot water to health care facilities and institutions
MDG 5: Improve maternal health	· Reduce maternal and infant mortality and morbidity
MDG 7: Ensure environmental sustainability	· Drastically reduce cutting of mountain forests and shrubs · Slow down or completely stop the processes of denudation of mountain slopes, restore mountainous pastures · Increase the area of green cover on mountains · Reduce the frequency and magnitude of devastating natural disasters · Increase the quality and quantity of the country's recreational and natural zones

TABLE 3. Impact of Energy Access (through renewable energy sources) on Accelerating Progress toward MDGs



BOX 1.
A CASE FOR A SMALL HYDRO POWER PLANT IN THE VILLAGE OF DARG

The village of Darg (Zerafshan Valley, Sughd Province) is located 67 km from the 'South – North' high voltage line "South – North". There are two options to supply the village with electricity: i) building a 35 kW transmission line from this high-voltage line to Darg, or ii) constructing a small, derivation-type 3,000 kWt power plan on the channel of a mountain stream Farzot that runs next to the village. Although building a transmission line would provide energy to other villages along the line, it would require investments 9.5 greater than that needed for constructing a small power plant in Darg. The latter would require the lowest capital cost per 1 kW of the plant capacity (US$0.6). In addition, the transmission line would be exposed to the permanent threat of rock falls along a distance of 67 km, which would make the supply of electricity unreliable.

establishments – make construction of high-voltage power lines neither cost-effective nor practical.

In the tributaries of the mountainous rivers, it is economically more efficient to build micro, mini and small hydropower plants with capacity of up to 3,000 kWt. It is possible to construct small power plants and to bring them into operation within a short period of time.

According to the calculations of the Association of Energy Engineering Specialists of Tajikistan, the development of small power enables the creation of 40 new jobs per each megawatt of energy supply (see Table 4). If, in addition to small-scale energy development, Tajikistan also prioritizes and implements a policy of developing labour-intensive and capital-saving (efficient) industries, the positive effects will be even greater – each megawatt of energy would create 80-100 jobs. If every rural family in Tajikistan were provided with an additional 1-2 kilowatts of electricity per day, there would be a 15-25 percent reduction in poverty. Since increasing employment is the most important factor in reducing poverty, this means that, by 2015, the country would be able to reduce poverty by more than envisaged in the MDG target, which seeks to reduce poverty to 41.5 percent by 2015.

The increase in decentralized energy supply is particularly important to reduce poverty rapidly. It would significantly reduce household expenditures on coal, wood, oil and other fuels, releasing a part of the household budget for buying food, clothing and other essentials. Improving energy supply is necessary to increase drinking water supply to villages, improve sanitation in urban and rural areas, develop domestic industries, expand the rural non-farm sector, reduce the prevalence of infectious and other diseases, and increase sustainable provision of social services, especially in rural areas and areas with a high proportion of vulnerable groups.

TABLE 4. Potential for Employment Generation through Small-Scale Energy Services

Population of Tajikistan	7,500,000
Living in rural areas	70%
Living in poverty	50%
Average number of household members	10
Number of most vulnerable population	1,000,000
Number of households	100,000
Average size of small HPP (in kW)	100
Estimated investment costs for the average to small HPP of 100 kW (US$)	100,000
Share of local goods and services related to HPP construction	50%
Jobs created per 1 MW of HPP installed	40
On-grid time (h/a)	3500
On-grid price (US$)	0.03
Intensity for on-grid production (US$)	0.01
On-grid power (share of the nominal HPP power)	50%
Estimated per capita annual consumption of fuel wood for cooking (m3)	0.5
Estimated per capita total annual consumption of fuel wood (m3)	1.0
Estimated absorption on CO2 in trees (CO2/m3)	1.8

Source: Authors' calculations based on the data from the Statistics Agency and Association of Power Engineering Specialists of the Republic of Tajikistan

The above table shows that, if about 1,000 small-scale energy plants were constructed, they would supply every poor family (1,000,000 people are estimated to be poor) with an additional 1 kWt of electricity per day. This would make a sizeable contribution to reducing poverty and generating employment. It would improve educational and health outcomes of poor households. It would also strengthen environmental sustainability by minimizing the use of wood for fuel. By providing guaranteed lighting, it would improve the quality of life of poor households and improve the level of their social interaction.

Therefore, the strategic intervention should focus on improving the energy supply for the population through small energy development, particularly renewable energy (e.g., small rivers and streams, wind, biomass and geothermal energy).

BOX 2.
CLASSIFICATION OF HYDROPOWER PLANTS (HPPS)

According to the classification used in Tajikistan, small-scale hydropower plants include plants with capacity from 10 kWt to 30 MWt and they are further subdivided into mini, small and micro HPPs.

Micro HPP with a capacity of 1 to 10 kWt
Small HPP with a capacity up to 10 MWt
Mini HPPs from 10 to 30 MWt

} **Small-scale energy sources**

Large HPP with capacity over 30 MWt

Source: Official classification of hydro-power plants adopted by a legal act of the Republic of Tajikistan

Measures Taken for Renewable Energy Development

In recent years, renewable energy development has received increased attention in Tajikistan. The Government of Tajikistan, local communities and private sector are taking steps to improve energy supply by developing small-scale power.

Tajikistan now has formed the initial legal and institutional framework for the accelerated development of small-scale energy in the country. On February 2, 2007, the government passed a resolution approving an integrated program on the use of renewable energy sources for 2007-2015 that covers small-river, solar, wind, biomass and geothermal energies. On February 23, 2009, Majlisi Namoyandagon of the Majlisi Oli of Tajikistan adopted the Law of the Republic of Tajikistan "Concerning the use of renewable energy sources", «The long-term program for construction of small power plants for the period 2009-2020" and "The program on development of a fuel and energy complex of RT until 2015". These documents reflect new international practices, new technologies and concepts in small-scale power development, which can be successfully used in Tajikistan.

In the country, there is increased activity of local communities that are building small hydropower plants on the principles of self-financing. This is very important, given the scarcity of resources in the local and central budgets.

Residents of Gorno-Matcha (Soghd region) and Rushan Districts (GBAO) have constructed 30 and 14 micro-HHPs, respectively. These power plants have been constructed solely using funds mobilized from the public, including migrant workers abroad and rural entrepreneurs. In recent years, more than 60 micro- and mini-hydropower stations were built in the Gorno-Badakhshan Autonomous Region (GBAO). Of these, 45 stations are in Rushan District. They were built as a result of close partnerships between local communities, district authorities and international organizations. Overall, the public has provided more than 60 percent of investments for the construction of hydropower, including from savings of households that receive remittances from their closest relatives. Surveys show that the number of micro-, mini- and small hydropower stations in the Gorno-Badakhshan Autonomous Region (GBAO) in the near future could increase several times.

BOX 3.
COMMUNITY INITIATIVES IN SMALL ENERGY DEVELOPMENT

Residents of the mountain village of Barodzh in Roshtkala District (GBAO) constructed a small hydropower plant of 14 kWt in 2007. It provides electricity to over a quarter of residents, feeding the local television station. Thirty-two families took the initiative and raised money for the construction of the hydropower plant. Local specialists built the HPP. During construction, 'hashars'[2] were periodically organized, mobilizing the entire population, including children and the elderly. At present, the rest of the population of the village is saving money in order to increase the HPP capacity to 60 kilowatts to meet the needs of the whole village. Most of the money was raised by households that have migrant workers outside of Tajikistan.

BOX 4.
DONOR INITIATIVES IN SMALL ENERGY DEVELOPMENT

The Center for Research on the Use of Renewable Energy Sources (CRURES), a subsidiary of MSDSP Aga Khan Foundation, and the European Union are implementing a project "Dissemination of renewable energy installations in the mountain areas". The project, with a total cost of $57,000, is now in its final stage. It is being carried out in Muminobod, Shurobod and Khovaling, the mountainous areas of the Kulyab zone. In these areas, three types of renewable energy devices are placed: 15 photovoltaic stations, four wind power plants, and four plants for biogas production from biomass and animal waste. The project made significant efforts to educate local people about the benefits of new technologies for using renewable energy sources. CRURES has also conducted a study among the population on the proper and effective use of small power facilities. The project has conducted training sessions with local residents to educate and expand the use of such facilities. Similar projects are planned to be implemented in the mountainous areas of Tajikistan in the future.

Addressing the current energy crisis and further improving access to reliable and affordable energy would have a catalytic effect on Tajikistan's achievement of most MDGs. The geography of Tajikistan and the distribution of its abundant renewable energy resources throughout its territory make the development of small-scale energy a better choice. Existing initiatives clearly demonstrate that, unlike large power plants, small HPPs are financially feasible and can be constructed within a short period of time. It is therefore necessary to refocus attention on the development of small-scale energy as a strategic intervention to accelerate the achievement of MDGs. In order to implement this strategic intervention, it is necessary to look at existing bottlenecks, be they financial, technical, institutional or societal.

[2] Hashars are public works, organized at the initiative of rural communities.

SECTION 3.

Bottleneck **Analysis**

Shakhrak village, Muminobod, 28 June 2009.

Poor and deteriorating access to energy in Tajikistan is a systemic problem that can only be solved through integrated actions. However, this requires knowledge of which problems should be tackled through which actions. The MDG Acceleration Framework presents a methodology to address such this issue, by guiding policy makers and development practitioners through several steps: 1) identifying strategic interventions to accelerate progress to MDGs; 2) analyzing bottlenecks to these interventions; 3) finding solutions to address the bottlenecks; and 4) drawing up an action plan clarifying the roles and responsibilities of different stakeholders. The strategic intervention, improving energy access in Tajikistan through small-scale energy development, was discussed in the previous chapter. This chapter analyses the bottlenecks to this intervention and analyses them in detail. These bottlenecks are also succinctly presented in Table 5.

Following the MDG Acceleration Framework methodology, the bottlenecks can be divided into several categories: (a) policy and institutional bottlenecks; (b) budgeting and financing bottlenecks; (c) service delivery or supply bottlenecks; (d) service use or demand bottlenecks; and (e) cross-cutting bottlenecks. Analyzing these issues faced by small-scale energy development into specific bottlenecks helps to identify specific and practical solutions.

Policy and Institutional Bottlenecks

The bottlenecks to the development of small-scale energy need to be first addressed at the policy and institutional levels.

Despite increasing realization by the authorities of the importance of energy, access to energy is still a low priority among policy makers. In key policy documents of Tajikistan, such as Economic Development Program in Tajikistan Until 2015 and The Concept of Transition of the Republic of Tajikistan to Sustainable Development, access to energy is not given the attention it deserves. Attitudes toward resolving energy problems are purely technocratic and do not adequately consider the socio-economic benefits of the development of small-scale power. The energy crisis in 2008 has brought the importance of energy access to the fore. Nevertheless, key stakeholders have vested interests in building large hydropower stations and resist the development of small-scale renewable energy sources throughout the country. They include, for example, energy sector authorities, large energy producers, large businesses, local authorities, urban consumers and even civil society. Often, powerful stakeholders lobby to divert budget resources intended for the development of small-scale energy into large hydropower (purchase of spare parts for large power stations, overhaul and repair of large power stations, repair of energy infrastructure, etc.). Barqi Tojik, the main energy sector player, has a dual function as a regulator of the energy sector and the largest energy producer. Despite being the foremost authority on energy in the country, it has little knowledge about the specifics of the small-scale energy sector.

Although Tajikistan has already established an initial legal framework to support the development of small-scale power, the necessary regulations

are not yet in place. At the same time, there are no regulations at the regional and local levels to create organizational, technical and socio-economic prerequisites for constructing and operating small power plants. For example, standards specific to small-scale energy have not been developed. It is not clear how public-private partnerships would work to finance small-scale energy projects. Tariffs are currently determined on an ad hoc basis. There is no clarity on how revenue- and cost-sharing would function if small-scale energy stations were connected to the central energy grid.

The lack of resources to undertake research that could inform policy also reflects the lack of attention to the small-scale energy sector. There are no objective, recent data and research on renewable energy resources in the country. The most recent comprehensive study of hydropower resources, A Scheme for Small Stream Hydropower Resources for Rural Electrification of the Tajik SSR, was conducted by the Tajik Scientific Research Department of Energy in 1950. These research materials still form a basis for all research and publications in this field. Yet, in addressing specific issues, these data need to be updated based on the current state of science, technology and climate. The Ministry of Energy and Industry has only preliminary data on potential renewable energy resources. It is necessary to conduct extensive feasibility studies to assess existing energy resources, identify unaccounted resources, and assess their effectiveness for energy production.

Similarly, there is no reliable information about the actual sources of power supply to the population and the amount of greenhouse gas emissions from individual activity within the population. Studies would also enable assessment of actual energy resources used by the population and their greenhouse gas emissions, which vary among different regions of the country.

The combination of these bottlenecks – the low priority given to small-scale energy, the lack of understanding of the benefits of small-scale energy for achieving MDGs, the vested interests and resistance of key stakeholders, insufficiently developed legal and regulatory framework, and the absence of objective and recent data on renewable energy resources and actual energy sources used by the population – needs to be tackled systemically in order to address the other bottlenecks.

Budgeting and Financial Bottlenecks

The world is locked in a dependency on fossil fuels that are depletable and therefore unsustainable in the long term. Currently, though, the production of energy from fossil fuels is cheaper due to the economies of scale, as the vast majority of energy-producing devices have been designed and constructed to use fossil fuels. This situation will likely continue for the next few decades. Renewable energy sources are also less stable and have smaller capacity; addressing this will require more technologically advanced solutions and significant investment in research and development. Thus, renewable energy is still less competitive and requires government support.

In Tajikistan, in contrast, the abundance of renewable energy sources means that it is possible to develop the renewable energy sector relatively inexpensively. Nevertheless, this cost is still greater than what the country can afford. Limited resources are available from the government budget for renewable energy in general. In addition, although the development of small-scale energy has stronger justification for government support because it can reduce poverty and promote achievement of the MDGs, prioritization of large-scale hydropower diverts public resources away from small-scale energy development. Thus, the state budget does not provide sufficient financing for long-term investment in the Program on Construction of Small Power Plants for 2009-2020, which was approved on February 2, 2009.

The private sector is inherently interested in investments in those sectors that offer high returns. But even when commercial production of renewable energy is possible (as seen from the interest of Tajik businesses), the private sector does not have sufficient resources or access to foreign sources of finance for investment in clean energy projects. Foreign investors do not invest in the development of small-scale power in Tajikistan because of the unfavorable business climate, lack of relevant infrastructure, the low purchasing power of rural populations and certain difficulties linked to the transparency in business processes. Commercial banks are reluctant to finance investment in small power projects because of the higher risks and lower returns. Not only are there natural risks of building power plants in mountainous areas, but there are also risks of non-repayment of loans and non-payment of energy bills by low-income rural households. In addition, there is no state guarantee (through the tariff system) that the produced electricity will be sold at a reasonable price ensuring adequate return on investments. Finally, the lack of experience of financial institutions to analyze the effectiveness of investing in small-scale energy also plays an adverse role.

In the environment of limited availability of financing – and particularly of low-cost financing – remittances from Tajik migrant workers abroad are an important potential source of finance, even despite their having declined as a result of the financial and economic crises. Migrant remittances have largely financed most community-led initiatives to build small energy facilities. Nevertheless, there has not yet been a systematic approach to working with the Tajik diaspora and migrant workers; attempts are currently restricted to individual villages and Jamoats[3] . Even including remittances, the capacity of rural communities to finance investments is very limited and predominantly includes very small (micro) power plants that power only a small number of houses. There is a potential to create, with the participation of migrants and their households in Tajikistan, cooperatives and joint-stock companies that could build and operate energy facilities.

Thus, the lack of low-cost financing from public, private or community sources for renewable energy projects, and particularly for small-scale energy projects, is a major bottleneck.

Service Delivery or Supply Bottlenecks

There are several bottlenecks preventing the development of a functioning market for small-scale energy facilities in Tajikistan.

Despite the establishment of a general legal and regulatory framework, technical standards governing the design, construction, operation and maintenance of small-scale energy facilities have not been adequately developed. Technical standards are necessary not only to ensure the technical quality of energy facilities, but also to achieve economies of scale. Small-scale energy facilities need to be able to operate in different conditions (high mountains, large drops in water levels, changes in the composition of biomass, different chemical composition of geothermal waters, etc.). Standards should also determine the frequency and nature of maintenance and repair to ensure maintenance of equipment. In addition, technical standards are necessary to ensure that energy equipments and their component parts are compatible and replaceable, which will help reduce the cost of operation and maintenance of energy facilities. Finally, standards are necessary to ensure that maintenance and repair are conducted in accordance with the wear and tear, to prevent the risk of failure.

Whereas a set of such standards is needed to address the specific needs of small-scale power plants, they currently exist only for large-scale hydropower plants. Moreover, there are no guidelines explaining these standards and no system of monitoring and enforcement of standards for small-scale power plants.

[3] Tajik municipalities, third-level administrative divisions

The high cost of equipment for small power, combined with low electricity tariffs, limits the ability to purchase high-quality equipment and components. Therefore, the only alternatives are to import low cost, low quality equipment from the Chinese market and to develop the domestic production of equipment. In recent years, enterprises «Dawn of the East» and «Tajiktekstilmash» in cities Chkalovsk and Dushanbe established a production turbines and generators for small hydro plants. However, their production is not at a scale that enables them to lower their costs) because of the low purchasing power of the population and the lack of purchases from the state.

Near absence of research and development means that the potential of modern science and technological developments to introduce high-quality and low-cost technologies is left unused, which is also not conducive to the development of a renewable energy market.

After installing turbines and generators, it is necessary to ensure the consistent maintenance of small power plants. Factories manufacturing equipment for small-scale power plants do not provide after-sale servicing, while owners of power plants do not seek it. Tajikistan does not have companies specializing in the maintenance of small power facilities. Often, owners of small power plants have to seek the services of non-specialist firms, which increases costs and reduces the quality of maintenance. As a result, small power plants operate under a persistent technical risk of suspension of operations and are often not exploited to their full capacity.

One key factor that inhibits the development of production and servicing enterprises is the dearth of trained specialists to produce, to install, to service and to maintain small-scale energy facilities. Such skills are needed not only in the production and servicing companies, but also in rural communities that need basic skills to maintain or repair their power plants.

Insufficient technical standards, the lack of their monitoring and enforcement, a dearth of trained specialists, as well as market gaps at different steps of the value chain – from production or import of equipment and parts to their assembly, installation, operation and maintenance – create supply bottlenecks to the development of small-scale energy.

Service Use or Demand Bottlenecks

Some bottlenecks preventing the use of small-scale energy services are related to fundamental development problems in Tajikistan and cannot be solved only by improving access to energy. These include the high level of poverty, particularly in rural areas, the lack of economic opportunities and the resulting difficulty in paying for energy services. Nevertheless, as highlighted in the previous chapter, the development of small-scale energy would spur the creation of jobs in agriculture, mining and small non-agricultural industries, thereby contributing to addressing the problem of employment and poverty.

Other bottlenecks are specific to the energy sector and should be addressed as part of it. Low collection rates for electricity, heating and hot water are partially explained by the widespread practice of consumers to default on or delay the payments of their utility bills. This leads to delay in cost recovery and reinvestments into power plants. Small-scale power plants suffer to a lesser extent from the problem of non-payment because local residents themselves often finance the construction of small power plants.

Nevertheless, because tariffs for small-scale energy have not been developed, rates are determined on an ad hoc basis, which can potentially exclude the poorest segments of the population. Measures are needed to ensure more equitable access to energy, not only between urban and rural areas, but also within rural settlements. In addition, a system of incentives should be introduced to increase the interest and motivation among households,

economic actors and public organizations (such as schools, hospitals) to use clean energies from renewable energy sources.

Extreme winter conditions prevent physical access to many mountainous settlements. Therefore, specifically for small-scale power plants, it is practical to train residents in the basic maintenance and repair of power plant components such as turbines, generators and their parts.

Cross-cutting Bottlenecks

Finally, low awareness among the authorities, the private sector and the public about the socio-economic, environmental and financial benefits of the development of small power is a bottleneck that cuts across all other bottlenecks. The public, policy makers and the private sector have almost no information about renewable energy reserves or the potential of small rivers, the sun, wind, biomass and geothermal resources to produce energy. There is also little awareness about the availability of technologies for small-scale power generation in developed countries and other developing countries.

Table 5 summarizes these bottlenecks to improving access to energy through small-scale energy development in Tajikistan.

TABLE 5. Interventions and Bottlenecks

INTERVENTIONS	CROSS-CUTTING BOTTLENECKS	POLICY AND INSTITUTIONAL BOTTLENECKS	FINANCING BOTTLENECKS	SERVICE DELIVERY BOTTLENECKS	SERVICE UTILIZATION BOTTLENECKS
IMPROVE ACCESS TO ENERGY THROUGH SMALL-SCALE ENERGY DEVELOPMENT: • Construct, service and repair small-scale, renewable power stations • Increase the use of small-scale, renewable power stations • Create energy-autonomous towns and villages • Connect small power stations to the central grid	**Lack of information and knowledge among users and potential investors** → Potential users and investors have limited knowledge about renewable energy and technologies to use these resources.	**Underdeveloped/unutilized legal and regulatory framework on small-scale, independent power stations** → The framework law on renewable energy has been developed, but it lacks detail. It is not clear how public-private partnerships can work to finance small-scale energy projects. Standards specific to small-scale energy have not been developed.	**Lack of public financing** → Limited resources available from the budget. Large-scale projects are prioritized over small-scale projects. → Lack of recognition of social and environmental benefits (MDG benefits) of small-scale, renewable energy	**Inadequate standards for small-scale energy** → Existing standards are designed for large-scale energy stations requiring far greater costs and technological capacity than is needed for small-scale stations. → Standards are poorly enforced and monitored	**Lack of clarity on tariffs** → No guidance on tariffs for small-scale energy stations. Currently, small energy tariffs are determined on an ad hoc basis. Tariffs are determined by each small-scale energy station owner on ad hoc basis. There is no clarity on cost- and revenue-sharing if small-scale energy stations are connected to the central grid. **Lack of incentive mechanisms to promote the use of renewable energy** **Lack of mechanisms to ensure inclusive energy access** → The legal framework does not provide guidance on tariff-setting; subsidies for energy use do not cover small-scale energy.
IMPROVE ACCESS TO ENERGY THROUGH SMALL-SCALE ENERGY DEVELOPMENT: • Construct, service and repair small-scale, renewable power stations • Increase the use of small-scale, renewable power stations • Create energy-autonomous towns and villages • Connect small power stations to the central grid	**Lack of information and knowledge in the government** → Government authorities have limited knowledge about potential renewable energy resources and technologies to use these resources.	**Institutional framework not designed for small-scale energy development** → Barqi Tojik, the main energy producer, also regulates the energy sector. It has limited knowledge about the specifics of the small-scale energy sector. → Resistance by large energy producers to prioritization of small-scale energy	**Lack of private financing** → Reduction of remittances of labor migrants due to financial crises → Lack of knowledge among potential investors (including the diaspora) → High risks and low returns on investment in renewable energy and particularly small-scale renewable energy	**Weak supply chain (production/import, assembly, installation and servicing of equipment and parts)** → Imported and produced equipment and parts do not conform to unified standards and dimensions, making it more costly to service and repair energy stations. → Servicing and maintenance is not performed routinely, thereby increasing the risk of failure. → Equipment and parts are costly → Existing local production of small-scale power plants equipment and parts is not established at scale, resulting in high cost per unit.	**Low ability to pay** → Lack of economic opportunities, particularly in rural, mountainous areas. → Poverty of residents, reducing demand of the population **Low levels of payment** → Users are accustomed to default on their energy bills.

INTERVENTIONS	CROSS-CUTTING BOTTLENECKS	POLICY AND INSTITUTIONAL BOTTLENECKS	FINANCING BOTTLENECKS	SERVICE DELIVERY BOTTLENECKS	SERVICE UTILIZATION BOTTLENECKS
		Low priority given to small-scale energy development → Strategy on small-scale renewable energy development exists, but has not been implemented. → The potential of small-scale strategy is not recognized and reflected in key strategic documents.		**Shortage of qualified specialists on construction and servicing of small-scale power stations** → Lack of trained specialists to produce equipment and install small-scale power stations → Lack of trained specialists to service small-scale power stations	**Low ability of users to maintain small-scale power stations** → Users lack basic skills and knowledge to maintain and service small-scale power stations, which is particularly needed during cold seasons when roads become impassable. It also can help reduce the costs of maintenance.
		Absence of research on potential and actual resources → Absence of studies on potential resources of renewable energy → Absence of studies comparing social and environmental benefits of small-scale, renewable energy **Lack of public-private partnerships in financing of small-scale energy development** → Lack of models of private-public partnership to finance small-scale energy projects → Lack of a legal and regulatory framework to guide public-private partnerships		**Lack of research and new technology** → Limited knowledge about new and more efficient technologies used in other countries **Lack of incentive mechanisms to promote the supply of renewable energy** → Lack of government support of the clean energy sector Difficult climatic and geographic conditions → Imported equipment and parts are not always suited to operation in high mountainous areas and in winters. → Seasonally impassable roads	

SECTION 4.

Acceleration of MDG Progress: **Identifying Solutions**

Khorog, Pamirs. 14 July 2010.

Building on the legislative measures already taken at the national level and on successful local partnerships between communities and other actors that helped build and maintain a number of small-scale power stations, it is necessary to identify solutions that address the bottlenecks mentioned above. These solutions are discussed in this section and summarized in Table 6, the MDG Acceleration Action Plan.

Despite the fact that the legislative framework for supporting the development of small power already exists, it is necessary to adopt appropriate regulations and standards. Decisions of the government, ministries, and local authorities are needed along with a mechanism to accelerate the development of small power. Public-private partnership mechanisms should be developed to create favorable conditions for the development of small power.

It is very important to motivate various players to assist them to increase the use of renewable energy sources. Such players include both research and development institutions and interdisciplinary centres. While research and development institutions would work to create technological innovations, improve existing plants and equipment, and adapt to the different conditions of the country's regions, interdisciplinary centres for sustainable development would address a wider range of issues to accelerate the development of small power, the protection of ecosystems, the reduction of the negative impact of anthropogenic changes on the environment, and training for the use of renewable energy.

One major problem is finding the necessary resources for the development of small renewable power projects. The financial resources of local authorities, local businesses and local communities are limited. At the same time, there is a growing number of examples of initiatives whereby local communities succeeded in mobilizing resources to build small hydro, wind and biomass energy plants. Whereas micro hydropower plants – the smallest has a capacity of up to 10 kWt – can be constructed by local communities, construction of small hydropower plants (larger in size, with capacity of up to 10 MWt) requires a mechanism of public-private partnership, involvement of central and local authorities, as well as local entrepreneurs. A part of external public borrowing should be refocused on the development of small power. Mini hydropower plants – the largest among small-scale have a capacity from 10 to 30 MWt – can be built with foreign direct investments and funds, deposited in foreign banks by Tajik migrants. This requires improving the investment climate in the country, particularly in rural areas.

To use the available opportunities for the rapid increase in electricity production in isolated mountain valleys, it is necessary to create a consolidated autonomous fund for the development of small-scale energy. It should include funds from international organizations, local and central authorities, economic entities and the population. Raising these funds and regularly replenishing them will be an important condition for the removal of obstacles to financing

the establishment of autonomous power supply systems in remote and isolated mountain areas.

For saving resources in the construction of small hydropower plants, the fullest possible use of local building materials and public works is required. Local communities should participate and volunteer in the construction of HHPs to generate the energy they need.

The purposeful accelerated development of small-scale power requires a feasibility study conducted for each facility that will help to determine the priorities for construction of small hydro power plants and other renewable energy sources plants. Priority should be given to those projects which can not only provide light and heat to residents and social establishments, but also promote the use of local natural and economic resources. Prioritization of small-scale energy projects should be linked with mining and quarrying activities, enrichment plants, irrigation to newly reclaimed agricultural lands, improving the productivity of farms though the use of electricity, growing fodder, intensification of animal husbandry, etc. All of this has a synergistic effect on the major factors of poverty reduction, growth in household incomes, creating employment and increasing food production. Preference should also be given to projects that prevent deforestation and the cutting of shrubs, the restoration of grass pastures and hillsides, the reduction of soil erosion and the reduction of salinization processes in mountainous areas.

It would be appropriate to provide incentives for the development of specialized firms that could import equipment and parts from China and other countries, subsequently assemble them and install or construct small-scale power plants. In this context, it is necessary to build on existing capacity by restructuring existing enterprises producing equipment for small power plants, so that they use new technologies and ideas emerging from both within Tajikistan and other countries. For the time being they are manufactured by two state-owned enterprises. The experience of many countries shows that the units for micro hydro plants can be produced in certain locations, including large rural areas which already have skilled personnel, specialists in manufacturing and assembling of equipment for small-scale power, as well as the necessary metalworking and other. Equipment for mini and small hydropower plants can be produced within the private and corporate sectors by privatized engineering and metalworking companies with specialized expertise, components and parts.

In addition to improving currently produced equipment for small hydropower, it is necessary to begin producing wind power, solar-thermal and geothermal devices for the production of biogas from dung, as well as crop residues and weeds. With the assistance of external experts, it is possible to start the design and mass construction of so-called 'passive,' or 'solar houses' in rural areas where both solar and internal heat is stored.

Following the experiences of advanced countries in Europe and Asia, Tajikistan has all the opportunities to create energy-sufficient villages and towns using renewable energy sources with the initiative of local communities and civil society. Such urban and rural settlements could combine hydropower with solar, biogas, wind and geothermal energies. For example, around the geothermal zone of Dzhilondy in the Shugnan District of GBAO, many small power plants can be constructed to form an autonomous power system covering several villages that would be provided not only with electricity, but also domestic heating. These villages also would specialize in the production of vegetables and fruits in greenhouses, which would be grown year-round and sold in the city of Khorog and surrounding areas. In Murghab district, based on the study and application of experience of Germany, villages can be made energy-autonomous by creating a combination of solar and wind energy systems. The energy resources in these regions could generate energy in excess

of consumption; the surplus could be used for the development of agriculture and traditional crafts.

In the mountainous desert where Murgab district (GBAO) is located, on average 300-320 days a year are sunny, creating favorable conditions for the use of solar energy. The cost of 1m2 of solar energy collectors is around US$300-450. These factors would allow using solar energy on a large scale.

These proposed solutions of bottlenecks are listed in more detail in Table 6.

SECTION 5.

MDG Acceleration Plan: **Building a Compact**

Shakhrinaw, Rasht, 4 July 2009. Father and boys have built micro phh for their small village and, are clearing its water supply channel.

The rationale for interventions aimed at accelerating the development of small-scale energy, which will be fully focused on the use of renewable energy sources, will undoubtedly assist in accelerating progress toward the MDGs by 2015. Nevertheless, the question of the complete solution of all problems in achieving the MDGs is subject to extensive discussions in Tajik society, in government and academic circles, and among various civil society groups. For the rapid development of small power, Tajikistan needs substantial scaling up of international scientific-technical, economic and humanitarian cooperation, because accelerated development of small-scale energy requires innovative technologies and ideas. Developed countries are currently experiencing a 'boom' in the development of technologies and ideas on the use of renewable energy sources. At the same time, their effective use in Tajikistan requires appropriate institutional support, as well as the development of necessary legal framework.

Before identifying small-scale energy as a key determinant of acceleration of the progress toward the MDGs, a series of consultations were held with academics, leading economists, energy engineering specialists, and experts in renewable energy from CRURES and MSDSP. Consultations were also conducted with local communities during the implementation of other UNDP projects to assess the effect of renewable energy sources on poverty alleviation and acceleration of progress toward the MDGs. The consultation processes involved scientists and experts in energy and renewable energy development from Tajik academic institutions, as well as specialists working on the Poverty Reduction Strategy and Energy Sector Development Strategies. In addition, the consultations were attended by representatives of businesses that invest in the construction of small-scale energy stations.

The latest consultation was held during the Development Forum of donors in Dushanbe on 3-4 December 2010. The meeting brought together international financial institutions and donors, including those active in the energy sector, the World Bank, the Asian Development Bank, European Bank for Reconstruction and Development, and the European Commission. During the meeting, the Government of Tajikistan presented its priorities, one of which was the development of small-scale energy. The Development Forum resulted in a plan to establish an institution for the financing and construction of small-scale hydropower plants and other alternative energy generators in Tajikistan, which would take the form of a cooperative or a joint stock company.

TABLE 6. Action Plan

Interventions		Bottlenecks	Solutions	Budget	Partners
IMPROVE ACCESS TO ENERGY THROUGH DEVELOPMENT OF SMALL-SCALE ENERGY SOURCES • Construct, service and repair small-scale, renewable energy stations • Increase the full utilization of small-scale energy stations • Establish energy-autonomous towns and regions • Connect small-scale energy plants with the central grid	Cross-cutting	Lack of information and knowledge among potential investors, including migrants abroad	• Inform and publicize among potential investors • Inform and publicize among migrants and diaspora	US$ 50,000.00	Embassy of Tajikistan in the Russian Federation Ministry of Labour and Social Welfare **Partners:** DFID, UNDP
		Lack of information and knowledge among users	• Develop mobile demonstrations of small power plant facilities	US$ 150,000.00	Ministry of Culture Radio and Television Committee Ministry of Foreign Affairs Barqi Tojik **Partners:** India, China, UNDP
		Lack of information and knowledge in the government	• Organize conferences, roundtables to learn from other countries' experiences	US$ 50,000.00	Ministry of Industry and Energy
	Policy and planning	Low priority accorded to small-scale energy	• Develop a national strategy on small-scale energy • Make changes to relevant strategic documents	US$ 50,000.00 US$ 30,000.00	Ministry of Industry and Energy Parliament
		Undeveloped legal and regulatory framework	• Develop legislation/regulatory framework on small-scale energy (by energy resources) • Develop regulations and by-laws on small-scale energy	US$ 20,000.00 US$ 50,000.00	Ministry of Justice Parliament Ministry of Industry and Energy **Partners:** World Bank, UNDP
		Institutional framework not designed for small-scale energy operations	• Create a small energy department in Barqi Tojik	US$ 50,000.00	Barqi Tojik **Partners:** World Bank, UNDP
		Lack of a legal and regulatory framework for public-private partnerships in small-scale energy development	• Develop legislation on public-private partnerships in renewable energy • Establish cooperatives in rural areas and joint-ownership companies in towns	US$ 30,000.00 US$ 50,000.00	Ministry of Economic Development and Trade SME Association
		Lack of research to support formulation of policies on small-scale energy	• Conduct technical studies determining renewable energy resources • Conduct studies to determine actual sources of energy used by the population to determine emission levels • Conduct feasibility studies on technical, economic, social and environmental aspects to prioritize projects	US$ 55,000.00 US$ 40,000.00 US$ 45,000.00	Academy of Sciences Association of Energetics of Tajikistan Academy of Sciences

Interventions		Bottlenecks	Solutions	Budget	Partners
IMPROVE ACCESS TO ENERGY THROUGH DEVELOPMENT OF SMALL-SCALE ENERGY SOURCES • Construct, service and repair small-scale, renewable energy stations • Increase the full utilization of small-scale energy stations • Establish energy-autonomous towns and regions • Connect small-scale energy plants with the central grid	Financing	Lack of private investment	• Inform and publicize among potential investors; actively seek foreign direct investment	US$ 60,000.00	**Partners:** World Bank, DFID, USAID, UNDP
			• Inform and publicize among migrants; mobilize resources from migrants and diaspora	US$ 50,000.00	Ministry of Labour and Social Protection **Partners:** USAID, UNDP
			• Provide incentives to commercial banks	US$ 10,500,000.00	National Bank of Tajikistan World Bank, ADB
			• Set up a small-scale energy fund	US$ 25,000,000.00	Tax authority
			• Set up schemes for credit/microcredit	US$ 10,000,000.00	First Microfinance Bank Associations of Micro Loan Organizations
		Lack of public investment	• Find financing through public borrowing	US$ 7,500,000.00	Ministry of Finance
			• Reallocate financing from other sectors to small-scale energy development (from the budget and ODA)	US$ 7,500,000.00	**Partners:** IMF, World Bank, EBRD, DFID, USAID, Asian Development Bank Islamic Development Bank
	Service delivery (supply)	Weak/non-existent standards for small-scale energy	• Accelerate the development of standards and guidelines	US$ 25,000.00	Barqi Tojik Certification and standardization authority Consumers Union
			• Ensure monitoring of standards by government	US$ 10,000.00	**Partners:** Asian Development Bank Soros Foundation GTZ
			• Ensure monitoring of standards by civil society and communities		
		Weak supply chain (production, import, installation and servicing of equipment and spare parts)	• Provide tax breaks and other incentives to companies that import or produce equipment and parts • Produce and distribute locally equipment and parts • Ensure orders from the public and the government • Provide timely servicing using local labor	US$ 2,500,000.00 US$ 250,000.00	Ministry of industry and energy NBT Customs and tax departments Barqi Tojik **Partners:** World Bank, Germany, GTZ Denmark, India, China, Norway, UNDP
			• Import of necessary equipment and parts • Connect some small-scale energy stations with the central grid	US$ 75,000.00	Ministry of Economic Development and Trade **Partners:** China India Barqi Tojik
		Shortage of qualified specialists in construction, installation and servicing of small-scale power stations	• Train specialists in higher education institutions • Train specialists in high schools and vocational training institutions	US$ 500,000.00	Ministry of Education RT
		Lack of research and new technology	• Create new research structures to facilitate adoption of new technologies		Academy of Sciences, Tajik Technical University

Interventions		Bottlenecks	Solutions	Budget	Partners
IMPROVE ACCESS TO ENERGY THROUGH DEVELOPMENT OF SMALL-SCALE ENERGY SOURCES • Construct, service and repair small-scale, renewable energy stations • Increase the full utilization of small-scale energy stations • Establish energy-autonomous towns and regions • Connect small-scale energy plants with the central grid	Использование услуг, пользующихся спросом	Climatic and geographic risks	• Create emergency stock of parts • Produce a catalogue of parts and equipment not suited for local conditions	US$ 500,000.00 US$ 20,000.00	Barqi Tojik **Partners:** World Bank Asian Development Bank, UNDP
		Lack of clarity on tariff-setting	• Formulate tariffs for small-scale energy • Ensure that tariffs are set in accordance with agreements • Introduce tax benefits on payments for renewable energy		Barqi Tojik, Consumer Society **Partners:** Asian Development Bank
		Low levels of payments for energy and low ability to pay	• Develop subsidized tariffs based on ability to pay • Introduce new meters able to disconnect non-paying users		Barqi Tojik Tax Department **Partners:** Asian Development Bank GTZ, UNDP
		Low ability of users to maintain small-scale energy stations	• Mobile demonstrations of small power plant facilities	US$ 50,000.00	Ministry of Culture Radio and Television Committee Ministry of Foreign Affairs Barqi Tojik **Partners:** India China
		TOTAL:		US$ 65,210,000.00[4]	

[4] These figures have been identified during the meetings and consultations with the representatives of the relevant national and international organizations, and are based on the national strategic documents such as the Poverty Reduction Strategy (PRS) 2010-2012, Strategy on Development of MHPPs (approved by Government in 2007), and the national programme on construction of MHPPs for the period 2009-2020.

BIBLIOGRAPHY

Government of the Republic of Tajikistan and United Nations, Review of progress towards the MDGs in Tajikistan, 2003, www.untj.org

Government of the Republic of Tajikistan and United Nations, Review of progress towards the MDGs in Tajikistan, 2005, www.untj.org

Government of the Republic of Tajikistan and United Nations, Review of progress towards the MDGs in Tajikistan, 2010, www.untj.org

Government of the Republic of Tajikistan, Economic Development Program in Tajikistan Until 2015, 2007

Government of the Republic of Tajikistan, Poverty Reduction Strategy of the Republic of Tajikistan for 2007-2009, Dushanbe, 2007

Government of the Republic of Tajikistan, The Concept of Transition of the Republic of Tajikistan to Sustainable Development, 2007

Statistics Agency under the President of the Republic of Tajikistan, Macroeconomic indicators in the 2000-2010 period, http://www.stat.tj

UNDP, «Tajikistan: MDG needs assessment», Dushanbe, 2005

UNICEF and World Bank, Tajikistan: Living Standards Survey 2007, www.worldbank.org/lsms

UNICEF and World Bank, Tajikistan: Living Standards Survey 2009, www.worldbank.org/lsms

United Nations, Strengthening the Global Partnership for Development in Times of Crisis: Report of the Task Force to Assess Progress in Achieving the MDGs in 2009, New York, 2009

LIST OF PEOPLE CONSULTED

1. Mirzohaydar Isoev, Programme Analyst, UNDP Energy and Environment Programme.
2. Farrukh Shoimardonov, RES Governance Advisor, UNDP Energy and Environment Programme.
3. Umedjon Ziyodaliev, Head of the Department, Ministry of Labor and Social Protection. .
4. Bahrom Aliev, Head of the Department, State Committee on Investment and State property management.
5. Timur Valamat-Zade, Energy Management Department, Ministry of energy and industry
6. Jamshed Samiev, Energy Management Department, Ministry of energy and industry
7. Firdavs Salomov, Key specialist, Ministry of Economic Development and Trade of RT
8. Zarnigor Yakubova, Specialist, Ministry of Economic Development and Trade of RT
9. M Usmonov, Key specialist, Ministry of Economic Development and Trade of RT
10. Shuhrat Murodov, Main specialist, Ministry of Economic Development and Trade of RT
11. Olimjon Mavllonov, Key specialist, Ministry of Health of RT
12. Dilshod Kimsanov, Deputy Chief of Management Department, Ministry of Melioration and Water Resources of RT
13. Alisher Alimatov, Head of PEO UKS, Ministry of Education of RT
14. Tagoymurod Sharipov, Chairman of GUP Galla, Ministry of energy supply of RT
15. Muazama Burkhonova – Independent Energy Expert, representative of Environmental NGO.
16. Alim Nasimov – Head of Science Unit, Ministry of energy and industry

All aforementioned people were actively engaged in the workshops (June, 2010) and a round table (September, 2010) within the UNDP Renewable Energy Sources project. As a result of these consultations, concerted efforts were directed towards creating an enabling environment and strategic policy advice in the renewable energy sectors, with the overall purpose of accelerating progress towards MDGs, including sustaining progress achieved and preventing the risk of reversal, and strengthening partnerships and mobilization of resources within the Republic of Tajikistan. Coordination of line ministries and strengthening their position on energy governance was identified as a priority for UNDP supported projects. As mentioned above, as a result of round tables the

Ministry of Economic Development and Trade of the Republic of Tajikistan was identified as the lead Ministry to facilitate the policy dialogue process on energy sector issues through an integrated rural development approach. In 2010, an inter-ministerial workshop was held with high level government officials, the head of state owned energy companies, such as Barqi Tojik, and other project stakeholders - to endorse the project. The outcome of this workshop was the formation of the Energy Task Force, which is a steering group comprising of government representatives across the 7 ministries (comprising individuals listed above). The Task Force serves as a mechanism for strengthening national capacities, and where international experts can provide high level strategic advice to the national government in addressing energy sector related issues.

February 2012