

Renewable Energy Country Profile Version 0.6b

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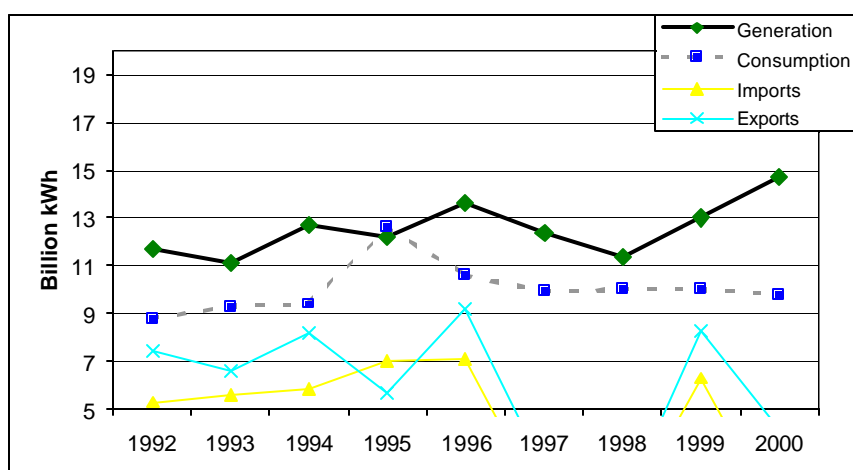
15.0 Kyrgyzstan

15.1 Overview of Electricity Supply

Kyrgyzstan is one of the poorer countries in Asia, with an economy that is primarily agricultural. Throughout the 1990's inflation remained high, with inflation of 18.7% in 2000, and GDP growth at only 5.7%.

Kyrgyzstan is a mountainous country with many rivers and lakes. Thus, there is significant hydroelectric potential, estimated in the range of 163 billion kWh in production per year. However, only about 10% of this resource is currently being utilized to produce 93% of Kyrgyzstan's electricity, with the balance in traditional thermal CHP plants used for district heating, and one nuclear power plant.

Fuel	Number of Facilities	Capacity (MWe)	Percent of Total
Nuclear	--	--	--
Thermal	N/A	831	22%
Hydro	N/A	2,949	78%
Other Renewables	--	--	--
Total	N/A	3,780	100%



The current generation capacity in Kyrgyzstan is more than adequate to meet electricity demand. In the early 1990's Kyrgyzstan imported nearly the same amount of electricity as was exported in order to supply certain regions as a result of system failures and

transmission and distribution problems. Overall, however, Kyrgyzstan is a net exporter of power with about 10% of annual production going abroad. The government has plans to increase this value, however, this cannot be done until significant renovations and expansions of the electricity grid are made. Current estimates are in the range of \$180 million to modernize the grid and allow for increased exports.

In 1998 and 1999 the government set out the legal basis for privatization of the energy industry. The electric grid has been divided into four regional companies and there are plans to issue the first international tender in 2002 to privatize the first of these companies. Electricity generation is still state owned and privatization is expected to proceed slowly, but the government plans to gradually decrease subsidies to the state electricity company, while beginning the process of increasing tariffs in order to finance system improvements before these assets are fully privatized.

1.1.1 Wind Resources

Current Status of Wind Energy²⁾

Currently there is no operative wind energy capacity in Kyrgyzstan.

A country wide wind-atlas is available. According to this wind atlas there are some large areas with wind speeds between 4 - 5 m/s only. However, some of these areas border

The Government of Kyrgyzstan has established the state project “Kun” to coordinate the development of renewable energy sources.

No industry association or manufacturer was identified.

No specific projects were identified.

The feed in tariff is not known..

Kyrgyzstan has a fair potential for wind energy development.

Wind Energy Resource Potential^{1) 2)}

“Master Plan of Wind Power Development of the USSR till 2010”, 1989 (MPWD) included a country-level wind map. According to this wind atlas Kyrgyzstan's wind power resources are limited to 4-5 m/s at 30 m height. However, some of these areas are adjacent to the Kazakhstan border, where wind speeds as high as 6 m/s are indicated, for example to the north of the capital city of Bishkek.

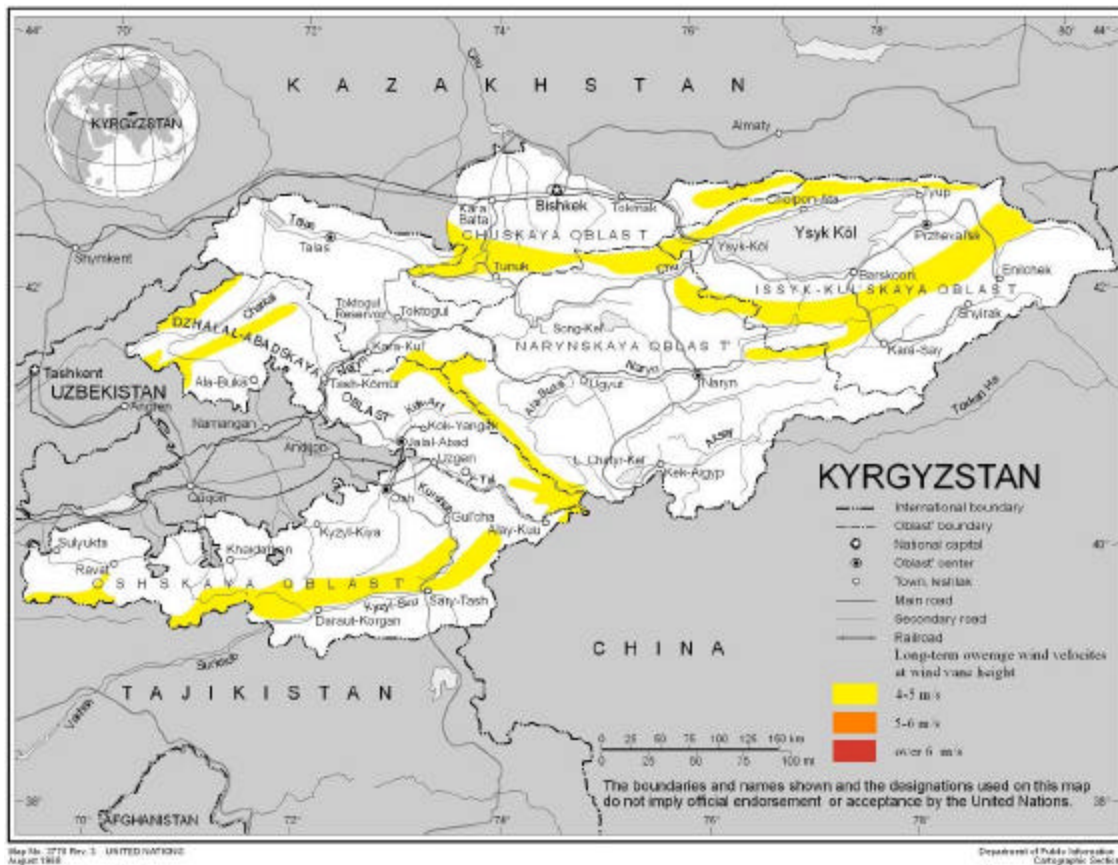
The 90×10^9 kWh/y technical potential, corresponding to 2'500 MW installed capacity, estimated in this study seems to be derived from the vast areas available for wind energy development. We would recommend to set this estimate at around 1'500 MW.

Under these circumstances we would rate the technical wind energy resource potential of Kyrgyzstan as good.

Identification of Areas/Projects with High Potential for Wind Energy

The most promising areas are as follows:

Northern part of the country (Chuisk district), Southern part of the country (Osh district), Eastern region of the country (Issyk-Koul district), Western region of the country (Djelal-Abad district)



Wind atlas of Kyrgyzstan

Table 1-2 Kyrgyzstan Areas/Projects with High Potential for Wind Energy..

Project Name and Location	Size (MW)	Description
Northern part of the country (Chuisk district)		Crest and northern off-spurs of the Kyrgyz ridge north from the capital city of Bishkek.
Southern part of the country (Osh district)		The Pamirs foothills at the border with Tadjikistan and Fergana ridge.
Eastern region of the country (Issyk-Koul district)		Mountain ridges south and west from the Issyk-Koul lake.
Western region of the country (Djelaal-Abad district)		Mountain ridges at the border with Uzbekistan.

Barriers/Incentives for Wind Energy

Specific incentives for the implementation of wind projects in Kyrgyzstan include:

- Since 2000 restructuring and privatization activities have been undertaken in Kyrgyzstan power development

Specific barriers to the implementation of wind projects in Kyrgyzstan include:

- Difficulties in locating the units in high mountain regions.
- Exceptionally low tariffs for electricity in the country.
- Very low prices of traditional fuel energy sources
- Absence of a legislative base to promote RES and lack of state support

- Lack of finance and absence of local investors interested in investing in these technologies
- Lack of information and a population that is not aware of the opportunities of RES

Table 1-3. Kyrgyzstan Wind Energy Profile.

Current status of wind energy	
Installed capacity	None
Projects under construction	None
Supporting regulations?	Yes. Kyrgyzstan has established the state project “Kun” to coordinate the development of renewable energy sources. ²⁾
Industry association?	Yes. Kun 1992.
Wind energy resource potential	
Level of information available	Fair
Highest wind class	Class 1-7
Country -level wind atlas available?	Yes. Very brief information.
Estimated potential (MPWD)	20*10 ¹² kWh/annum, gross (theoretical) potential 90*10 ⁹ kWh/annum, technical potential 100*10 ⁶ kWh/annum, economic potential
Target established?	Yes. The overall objectives of Kun are to develop a renewable energy strategy for the country.
High wind speed locations	Chuisk district Osh district Issyk-Koul district Djelal-Abad district
Identification of areas/projects with high potential for wind energy	
Recommended strategic assessments	Study 1 : Country wide appraisal of wind resources by wind measurements at 50 m height Study 2 : an appraisal of legal and economical frame work
Identified areas/projects	None
Incentives/barriers for wind energy	
Significant incentives	<ul style="list-style-type: none"> • Privatization activities • Government interest towards renewable energy resources
Significant barriers	<ul style="list-style-type: none"> • Complex terrain • Low tariffs for electricity
Overall Prospects	<p>Fair</p> <p>The Kyrgyz Government shows interest in renewables, but the wind energy potential seems to be poor, the electricity prices are too low and legal frame work is not in place.</p>

¹⁾ “Master Plan of Wind Power Development of the USSR till 2010”, 1989

²⁾“Opportunities for renewable energy sources in Central Asia Countries“, Alaibek J. Obozov, Project Kun Kyrgyzstan, July 1998

5.13 Kyrgyzstan Renewable Energy Profile

5.13.3 Solar Resources

Current Status of Solar Energy

At present the utilization of solar energy is mainly carried out in the direction of creating solar water heating plants on the basis of flat solar collectors, which are produced in the country. The general area of solar collectors being in operation constitutes 60 ths. m² [1].

Solar Energy Resource Potential

A maximum number of points, where the measurements of solar radiation take place and the mountain relief doesn't permit to compile the map the solar radiation incidence distribution at the territory of Kyrgyzstan. For evaluation of solar energy resource potential we will give the data on monthly and annual incidence of total solar radiation on a horizontal surface and on direct solar radiation on a surface normal to beams, which are averaged for measuring period of many years, for two points – Bishkek (a capital) and meteorological station Tien Shan. The first place is characterizes a part of the plains, while the second one – high-mountain one. The height of this station above sea level is 3614 m. The data were borrowed from [2].

Table 1

Monthly and annual total solar radiation incident on horizontal surface, MJ/m²

Name of place	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yearly
Bishkek	223	273	379	516	667	740	786	697	532	352	212	170	5547
Meteorological station Tien Shan	328	407	632	739	774	734	706	673	570	472	335	290	6660

Table 2

Monthly and annual direct solar radiation incident on surface normal to sunlight beams, MJ/m²

Name of place	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yearly
Bishkek	305	272	303	428	574	711	754	730	585	431	314	246	5633
Meteorological station Tien Shan	518	469	523	586	590	591	611	650	634	623	539	495	6829

As it follows from the data presented in Tables 1 and 2, the annual course of solar radiation has a considerable summer maximum that is typical for the area with continental climate.

Identification of Areas/Projects with High Technical Potential for Solar Energy

All the territory of Republic possesses the good climatic conditions for using solar energy. It is natural that the mountain and high mountain regions, as it follows from the data of Tables 1 and 2, have the largest potential for solar energy.

Barriers/Incentives for Solar Energy

The main braking obstacles for the development of using solar energy are the economic ones. The economy of Republic is not able to mobilize the considerable investments in this sphere.

At the same time there is an understanding at state level of the large importance that the renewable energy sources have for Republic under conditions of own traditional energy carriers deficit. President of Kirghiz Republic established a so-called Business Project “KUN” (Kun translated from Kirghiz language means Sun) on development of RES application. The Business Project “KUN” is an executive organ of state management under the government of Kirghiz Republic, which carries out and coordinates the state energy policy in the field of using RES. However as to using solar energy, it is foreseen in the frameworks of this project to use only the solar water-heating plants.

Table 13-3. Kyrgyzstan Solar Energy Profile.

Current status of solar energy	
Installed capacity	Solar water-heating plants with total power up to 30 kW.
Projects under construction	Business project “KUN”(SUN) on development of using renewable energy sources. In the part of using solar energy it is foreseen to use mainly solar water-heating plants
Supporting regulations?	Are absent
Industry association?	There are the enterprises for manufacturing the flat solar collectors.
Solar energy resource potential	
Level of information available	Poor
High range of solar insolation	3.5 – 4.0 kWh/m ² /day (worst month, [3]); up to 5.0 kWh/m ² /day (year average [2])
Country-level solar atlas available?	No.
Target established?	No data.
High solar insolation locations	The incidence of solar radiation in high mountain regions is by 20-35% more than in regions of the plains.
Identification of areas/projects with high potential for solar energy	
Recommended strategic assessments	Technical- and economic evaluation of possibilities and scales of using photovoltaic plants for energy supply of autonomous consumers and. First of all. In the mountain regions.
Identified areas/projects	Realization of project pointed out in item 1.2 in full volume and with development of solar energy within its frameworks.
Incentives/barriers for solar energy	
Significant incentives	Quite favorable solar climate. Shortage of own traditional energy resources. Active role of the state in development of traditional energy that is carried out in realizing the project pointed out in item 1.2.
Significant barriers	Absence of inner sources of investments in solar energy. Low tariffs for electricity and heat. Absence of legislative base.
Overall Prospects	Good because of existence of the state support.

References

1. A.D.Obozov, M.T.Berdibaeva “Modern status of developments and technology of renewable energy source in Kirghiz Republic”. Proceedings of the International congress “Business and investments for renewable energy in Russia”, Moscow, 1999.

2. Applied scientific reference book on climate of the USSR. Hydrometheoizdat, L., Issue 32, 1989.
3. Internet site: www.bpsolar.com/ContentDocuments/17/PV System Sizing Tools.zip

5.13.4 Geothermal Resources

Current Status of Geothermal Energy

Geothermal resources of Kyrgyz Republic are small and insufficiently studied. The application of thermal water consists mainly of balneology (Djalal-Abad Region, Fergana Basin). It is planned to use the thermal water in the area of city Bishkek and in the valley of lake Issyk-Kul [1].

Geothermal Energy Resource Potential

Geothermal resources are concentrated in the reservoirs formed in sediments of depressions and in the convective fissured hydrothermal systems of foothills. The evaluation of resources for two hot water fields was carried out. It included the following fields :

- Issyk-Ata (nearby Bishkek city); temperature 55 °C, TDS 0.5 g/l; total flow rate 690 l/s
- Ak-Su (Issyk-Kul Basin); temperature 60 °C, TDS 0.5 g/l; total flow rate 415 l/s.

Total thermal water resources in Kyrgyz Republic have not been estimated.

Identification of Areas/Projects with High Potential for Geothermal Energy

High potential geothermal resources for electricity production have not been identified.

Barriers/Incentives for Geothermal Energy

Specific incentives to the implementation of geothermal projects in Kyrgyzstan include:

4. Insufficient resources of organic fuel.

Specific barriers to the implementation of geothermal projects in Kyrgyzstan include:

1. Low geothermal resources.
2. Low electricity and heat tariffs.

Table 13-4. Kyrgyzstan Geothermal Energy Profile

Current status of geothermal energy	
Installed capacity (electric)	0
Installed capacity (thermal)	No data
Projects under construction (electric)	0
Supporting regulations?	No
Industry association?	No
Geothermal energy resource potential	
Level of information available	Poor
Country geothermal atlas available?	No. Atlas of Thermal Water Resources of the USSR contains only local resources estimation for two fields
Estimated potential (electric)	0
Target established?	No
High enthalpy geothermal locations	No
Identification of areas/projects with high potential for geothermal energy	
Recommended strategic assessments	No
Identified areas/projects (electric)	No
Incentives/barriers for geothermal energy	
Significant incentives	1. Lack of organic fuel resources.
Significant barriers	1.Small identified geothermal resources. 2.Low electricity and heat tariffs.

Overall Prospects

Poor .
Insignificant geothermal resources of thermal water and low heat tariffs
make the geothermal heat supply non-prospective.

References

1. G.Kulikov, B.Mavritsky *et al.* Atlas of Thermal Water Resources of the USSR. Moscow, 1984.

5.13.5 Biomass Resources

Current Status of Biomass Energy

Government of Kyrgyzstan created Center on the problems of using renewable energy resources (CPURER). Together with Kyrgyz Association of renewable energy resources CPURER works out a program of the development of renewable energy resources including biomass.

The Republic has the sufficient potential of R&D and production capacities of idle factories for beginning the mass production of biogas plants and their implementation.

Ten biogas plants with capacity from 2 to 40 m³ that has been erected by enthusiasts are currently functioning in Republic.

A majority of rural population (that constitutes about 65% of a total population of the country, i.e. more than 3 million people) has no opportunities to acquire a fuel for preparing food and heating (the village regions are not gasified in the country) because of poverty reasons. Therefore the forest stands and cherished forests including relic ones are cut out. Practically all lands under cultivation (1200 thousand hectares) obtained by peasants from the collective farms (that has been mainly liquidated) are not fertilized and catastrophic degenerated for more than 10 years. The emissions in atmosphere from cattle raising waste, which is decomposed at the open air, annually constitute more than one million cubic meters of methane. They pollute the ground and underground water flows and aquifers as well as water reservoirs and create the antisanitary conditions of people life.

.Biomass Energy Resource Potential

Table shows the overall biomass resource data for Kyrgyzstan.

Kyrgyzstan Biomass Resource Data (FAO 2002a, FAO 2002b).

Biomass resource type	Total production	Production density
Primary crop production, tonne	(avg. 1999-2001, tonne)	(tonne /1000 Ha)
Total primary crops (rank among COO)	8,322,126 (17)	434 (23)
Top 10 primary crops		
Mixed Grasses, Legumes	3,066,667	160
Wheat	1,154,405	60
Potatoes	1,019,732	53
Maize for Forage & Silage	622,667	32
Sugar Beets	448,490	23
Forage Products (misc)	376,667	20
Maize	281,806	15
Barley	203,353	11
Onions, Dry	151,005	8
Tomatoes	147,999	8
Animal units, number	(number)	(number / 1000 Ha)
Cattle	921,418	48
Poultry	2,854,000	149
Pigs	105,153	5
Equivalent animal units	992,019	52
Forest products, cubic meters	(avg 1999-2000, cu m eters)	(cubic meters /1000 Ha)
Wood fuel and charcoal	NA	NA
Wood residue s	NA	NA

The Republic is among the countries, the provision of which doesn't exceed 30% with their own energy resources: the coal mining constitutes 15-20% from needs, while the production of gas and oil is practically absent. Therefore the most part of fuels is imported from the neighboring countries.

Kyrgyzstan occupies the territory about 200000 km² located in the center of Eurasian continent on the high mountain range of Tien Shan and the Pamirs. The total area of agricultural lands in the Republic is about 10 million hectares including 1.2 million hectares of lands under cultivation. Among the latter there are 800 thousands hectares of irrigated lands giving 90% of plant growing products. More than 50% of agricultural lands are occupied by pastures that determined the main branch of agriculture – livestock breeding. The livestock breeding waste, which could be used after processing in biogas plants, constitutes 2500 thousand ton per year.

Identification of Areas/Projects with High Technical Potential for Biomass Energy

The program of using renewable energy resources, which is currently under development, supposes to use for processing in biogas plants 1200 thousands ton of livestock breeding waste with production annually of 600 million m³ of biogas and 1200 ton of liquid organic fertilizers that should provide the rural population with fuel. In this case all 100% of arable lands in Republic should provide the organic fertilizers – ecologically clean, having no weed's seeds and disease-producing microorganisms, being free of nitrates and don't create them. All 100% of rural population should be provided with fuel for preparing food and 30% of families - for heating in wintertime.

It is necessary for carrying out this program:

1. To create the revolver Fund of development and support of power engineering on the basis of renewable energy resources. This Fund will be attached to CPURER This Fund could annually provide more than 200 rural citizens of moderate and minimal means with low interest or interest-free credits for the period of 2-3 years (the payback period). The grant in amount of 1 million \$ is necessary for creating the Fund.

2. To create the experimental biogas plants in seven regions of Republic for information and attraction of investments from well-being rural population. For this purpose the grant in a size of \$ 220 thousand is required. The government of Kirghiz Republic has no such funds, and therefore the pointed problems can be solved only by means of foreign investors.

3. To develop the cooperation with foreign centers, which carry out R&D, manufacturing and introduction of biogas plants. To exchange the projects, normative documents as well as standards of designing, mounting and operating instructions for biogas plants with capacity of bioreactors up to 10 m³ and more.

Barriers/Incentives for Biomass Energy

The main reasons of unsatisfactory usage of biogas plants' opportunities are: a poverty of population as well as an insufficient information level of well-to-do rural population and a very small number of pilot plants.

Table 13-5. Kyrgyzstan Biomass Energy Profile.

Current status of biomass energy	
Installed capacity	10 biogas plants with volumes of bioreactors from 2 to 40 m ³
Projects under construction	No data
Supporting regulations?	Yes
Industry association?	Yes
	Center on problems of using renewable energy sources (TsPIVIE)
	Kirghiz association of renewable energy sources (KAVIE)
Biomass energy resource potential	
Level of information available	Good
Relative biomass potential (total / density)	Total: 2%; Density: 7%
Country-level biomass investigations available?	Yes
Estimated potential	More than 400 thousand toe, technical potential More than 200 thousand toe of biogas, economic potential
Target established?	Yes
High density biomass areas	No data
Identification of areas/projects with high potential for biomass energy	
Recommended strategic assessments	Study 1 Development of normative- methodological documentations on using biomass in energy purposes. Study 2 Creation of pilot biogas plants.
Identified areas/projects	No data
Incentives/barriers for biomass energy	
Significant incentives	1. Limited reserves of organic fuel. 2. Quite considerable wastes of agricultural production
Significant barriers	The main reasons of unsatisfactory usage of biogas plants' opportunities are: a poverty of population as well as an insufficient information level of well-to-do rural population and a very small number of pilot plants
Overall Prospects	Fair

References

The materials were presented by Center on the problems of using renewable energy resources (CPURER) attached to the government of Kyrgyz Republic.

Renewable Energy Profile (draft)

REPUBLIC OF KYRGYZSTAN

HYDRO POWER POTENTIAL FOR DEVELOPMENT OF SMALL AND MEDIUM SIZE HYDRO

According to the adopted classification, small HPPs are of capacity up to 30 MW, medium-size HPPs are of capacity up to 100 MW.

1. Current State of Hydro Power

Hydropower plays the main role in power sector of Kyrgyzstan. Hydropower accounts for 80% of total generating capacity. The installed capacity of 18 HPPs totals 2.9 million kWh.

Existing Hydro Power Plants in Kyrgyzstan

Hydro power plants	Installed capacity, MW	Share of HPPs in hydro power, %
Large HPPs	2870	98
Including: Toktogul	1200	
Kurpsai	800	
Tashkumyr	450	
Shamaldy-Sai	240	
Uch-Kurgan	180	
Small HPPs	48.7	2

2. Hydro Power Resources of Kyrgyzstan

By absolute indices of potential hydro resources and by concentration of potential hydro resources on the territory Kyrgyzstan is one of the first among the CIS countries.

Characteristics	Total	Indices	Share of HPPs, % from the total
		Including small HPPs of capacity up to 30 MW	
Gross theoretical hydropower potential, - Billion kWh/year - concentration of power resources on the territory, thou.kWh/km ²	142 718	44.5 224	31
Technically feasible hydropower capability, Billion kWh/year	73	12	16,4
Economically feasible hydropower capability, Billion kWh/year	48	2	4,2
Power generated by existing HPPs, - Billion kWh/year - per cent of economic potential, %	9 19	0.14 7	1.5

The major part of hydropower resources (30%) is concentrated in the basin of the Naryn River, the main river of the Republic.

At estimation of total hydropower potential of Kyrgyzstan small hydropower were singled out. The largest small hydropower potential is concentrated in northern, southern and eastern districts of the Republic.

3. Plans for Development of Hydropower Potential

Further development of hydro resources will be concentrated in the upper reaches of the Naryn River.

First Priority Potential Hydro Power Projects

Projects	Installed capacity, MW	Location
Rehabilitation of the abandoned HPPs: Onarcha HPP	100	On-Archa River, the Naryn tributary
New construction: Akbulun HPP	55	Upper hydraulic unit the cascade on the Naryn River

Programs of small hydropower development in Kyrgyzstan include reconstruction and renovation of previously constructed small HPPs, adding small HPPs to water management projects with already existing water retaining structures with the aim of utilizing waste releases, and construction of new small HPPs for power supply of users in the outlying districts of the power system.

Proposed Program of Small Hydro Development

Type of construction	Quantity	Installed capacity, MW	Average overyear power output, Million kWh	Note	Region
Reconstruction of existing HPPs	18	48.7	148	Mostly former rural HPPs of capacity within 0.4-8.7 MW	Northern districts of Kyrgyzstan
Adding to water management projects	18	218.1	990	Small HPPs of capacity within 0.6-30 MW	Mostly on the north and on the south of Kyrgyzstan
New construction	33	470.2	2258	Small HPPs of capacity within 5-30 MW	Mostly on the north and on the south of Kyrgyzstan
Total	69	737	3396		

First Priority Potential Small Hydro Power Projects

Projects	Installed capacity, MW	Location
Adding to existing water management projects:		
Kirov HPP	21	Existing reservoir on the Talas River
Ortotokoi HPP	21	Existing reservoir on the Chu River
Papan HPP	30	Existing reservoir on the Akbura River
Rehabilitation of abandoned HPPs:		
Leninpol	23	Talas River
Karkkazyk	24	Talas River

4. Unfavorable Factors for Development of Hydro Potential

- lack of investments;
- favorable power budget

Bibliography

1. Power Resources of the USSR. Hydropower Resources. A.N.Voznesensky et al.,1967
2. Small Hydropower, L.P.Michailov et al, 1989
3. Periodicals: Hydraulic Construction, Power Stations, etc

Zones of location of planned small HPSs

