WORLD SMALL HYDROPOWER DEVELOPMENT REPORT 2013

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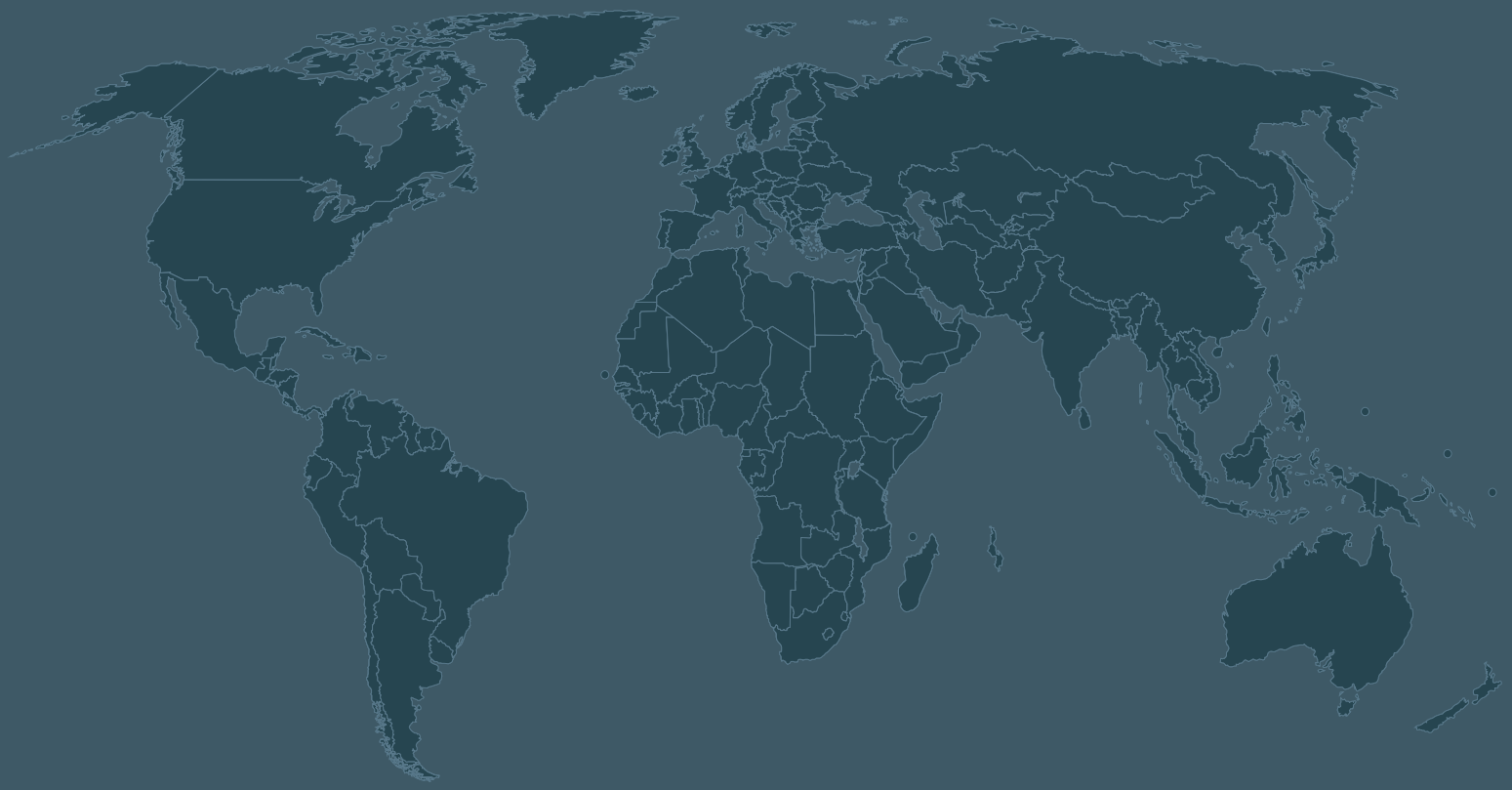
TAJIKISTAN



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3 Asia
3.1 Central Asia

3.2.3 Tajikistan

Ugranath Chakarvarty, International Center on Small Hydro Power

Key facts

Population	7,768,385[1]
Area	143,000 km^2.[1]
Climate	Mid-latitude continental, hot summers, mild winters; semiarid to polar in Pamir Mountains[2]
Topography	Pamir and Alay Mountains dominate landscape; western Fergana Valley in north, Kofarnihon and Vakhsh Valleys in southwest (highest point: Qullai Ismoili Somon, 7,495 metres)[2]
Rain pattern	Average annual rainfall in lowland hot deserts of northern Tajikistan and cold high-mountain deserts of East Pamirs: 70-160 mm, while in Central Tajikistan it may exceed 2,000 mm.

Electricity sector overview

Electrification access in Tajikistan is more than 90 per cent, still the country faces severe shortages of electricity. Around 74 per cent of the population resides in rural areas, but represents merely 8-11 per cent of the country's total electricity consumption. The capital of Tajikistan, Dushanbe, and the aluminium industry consume most of the electric power in Tajikistan.[3]

With 8,476 km^2 of glaciers, 947 rivers stretching over 28,500 km and 1,300 freshwater lakes, landlocked Tajikistan is blessed with abundant water resources.[4] Hydropower contributed about 98 per cent of total electricity production in 2009 (16 TWh), clearly indicating the prominence of hydropower in Tajikistan (figure 1).[5] A large part of the generation comes from large-scale hydropower plants, however due to the sparsely distributed population, small hydropower and especially micro and mini hydropower have an invaluable impact on the socio-economic life of Tajikistan.

The State-owned company Barqi Tojik is the energy monopolist in the country and deals with maintenance of electric power stations and networks, manufacturing, transmission, distribution and selling of electric and heat power.[6]

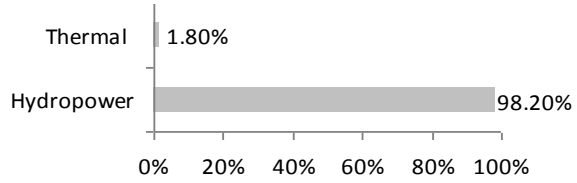

Figure 1 **Electricity generation in Tajikistan**
Source: Taj Hydro[6]

Small hydropower sector overview and potential

According to the Law of the Republic of Tajikistan on the Use of Renewable Energy Sources in 2010, hydropower is classified as micro, mini and small if the installed capacity is below 100 kW, 101-1000 kW, and 1001 kW-30 MW respectively. However, a document by the Ministry of Industry and Energy and UNDP Tajikistan from 2007 recommends that the classification be the following for micro <10 kW, mini 10-500 kW and small 500 kW-10 MW.[7]

According to Tajhydro, 155 small hydropower stations exist in Tajikistan within four regions with a total capacity of 12 MW (table 1 and figure 2). Technically small-scale hydropower in Tajikistan revolves around micro- and mini-hydropower, due to the low population density in rural areas.

Table 1
Installed small hydropower capacity in Tajikistan

Region	*Total SHP plants*		*Active SHP plants*			*Non-active plants*	
	Number	*Total capacity (kW)*	*Number*	*Capacity (kW)*	*Electricity generated (MWh)*	*Number*	*Capacity (kW)*
GBAO	35	3 432	15	725	497.8	20	2 707
Khatlon Oblast	8	2 185	-	-	-	8	2 185
Sughd Oblast	38	1 882	37	1 002	460.3	1	880
Districts of Republic Subordination	74	4 685	53	2 959	1 370.2	21	1 726
Total			**105**	**4 686**	**2 328.3**	**50**	**7 498**

Source: Tajjhdryo[8]
Note: GBAO - Gorno Badakhshan Autonomous Province

Most villages of the country are close to at least one water flow and thus of off-grid small to micro hydropower plants have been constructed and operated by local communities, providing electricity especially during winter when national electricity supply is mostly intermittent. Rivers in Tajikistan are characterized by high currents which make them freeze rarely. The associated equipments are made

from spare parts, but are not periodically maintained and thereby inefficient, and break down with some frequency. At the same time, local communities use such off-grid schemes and pool their limited resources to cover operations and maintenance expenditure.

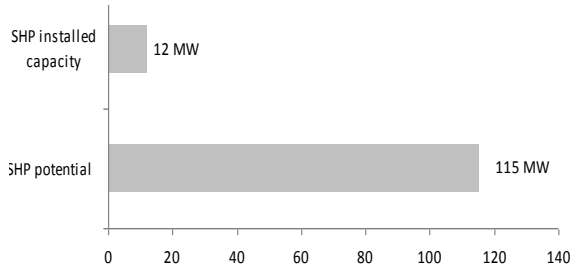

Figure 2 **Small hydropower capacities in Tajikistan**
Source: Tajhydro[8]

Since 2002, PamirEnergy has invested over US$37 million in maintaining the electrical infrastructure and developing small hydropower in the Gorno Badakhshan Autonomous Province (GBAO) region for a 25-year concession period. PamirEnergy has been providing electricity to 85 per cent of GBAO's population and is now managing all power generation, transmission and distribution in the region.[9]

The major part of Central Asia's water resources originates from Tajikistan (53 per cent), hence the country has one of the highest hydropower potentials in the world, estimated to be around 140 GW, with a potential annual electricity generation of 527 TWh and ranked second in the world by its per capita hydropower resources.[10] Technical hydropower potential amounts to 317.82 TWh and the total potential of small hydropower industry is 184.46 TWh per annum. All in all, Tajikistan is home to 4 per cent of the world's hydropower potential.[11]

In recent times, conditions for small hydropower have become favourable. According to Tajhydro's Small Hydro Power Development Center, preliminary researches show that 900 small scale schemes, each with output between 100-3,000 kW are technically feasible and economically efficient.[12] Use of small hydropower has been acknowledged by experts to be able to meet 50-70 per cent of rural areas energy demands and in some cases 100 per cent, based upon the presence of small rivers in predominantly mountainous areas.

In the long term, small-, medium- and large-sized hydropower stations in Tajikistan have the potential of boosting Tajikistan's economy by exporting electricity and meeting reliable domestic electricity needs for productive uses.

UNDP has been implementing several projects in collaboration with the Government of Tajikistan and has developed three strategic documents to confront poverty issues and development progress highlighting the use small hydropower, namely:[8]

- Intermediate Strategy for Renewable Energy Sources-based Integrated Rural Development (August 2010)
- National Program for Renewable Energy Sources-based Integrated Rural Development- National Scaling Up (October 2010)
- Energy Efficiency Master Plan (January 2011)

UNDP has also designed a National Trust Fund for Renewable Energy and Energy Efficiency in Tajikistan. Once the transmission networks to Afghanistan and Pakistan, which are under construction, have been completed, Tajikistan can enhance profitability by trading with these countries.

Table 2
Planned small hydropower plant capacity in Tajikistan, 2009-2020

Period	*Planned total installed grid connected capacity (MW)*	*Additional stand- alone capacity (MW)*	*Planned annual electricity production from the installed capacity (MWh/year)*	*Required money to incentivise newly installed capacity in given period (US$)*	*Total required money in the given period for incentives (US$)*	*Required money to cover investment costs of stand-alone plants (US$)*
2009-2011	43.53	5.00	280.84	5 616 868	5 616 868	5 000 000
2012-2015	32.85	18.62	185.07	3 701 344	9 318 212	18 620 000
2016-2020	26.80	73.20	175.74	3 514 706	12 832 918	73 199 000
Total 2009-2020	**103.18**	**96.82**	**641.65**	**12 832 918**	**27 767 998**	**96 819 000**

Source : United Nations Development Programme[13]

A preliminary assessment of finance required to incentivize small hydropower development for the period 2009-2020 is shown in table 2. Furthermore, UNDP's Energy and Environment Programme project 'Technology Transfer and Market Development for Small Hydropower in Tajikistan' in collaboration with the Global Environment Facility and UNDP, started in March 2012, will run until December 2015.[14]

Water infrastructure projects, including the development of hydropower capacity, are a complex issue related to the rights of downstream water users, especially in Uzbekistan and Turkmenistan. Both of

these countries depend on water from Amu Darya for irrigation purposes. The Water Sharing Protocol of 1987 limits the use of water for hydropower during winter by Tajikistan.[10]

With the collapse of Soviet Union, the profitable relationship of Tajikistan along with Kyrgyzstan, providing hydropower in summer to Kazakhstan, Turkmenistan and Uzbekistan and in turn receiving gas and electricity during winters, has ended. In recent times, water rights have become an issue of tension in Central Asia.

Renewable energy policy

Electricity supply in Tajikistan is unreliable and power cuts often recur. However, the potential to utilize renewable energy is tremendous with small hydropower as top priority and solar and wind as other potential renewable sources. The Law of the Republic of Tajikistan on the Use of Renewable Energy Sources was established in 2010, regulating legal relations between public authorities and stakeholders in the area of priority and effective use of renewable energy with an emphasis on international cooperation. It also aims at increasing the level of energy conservation, reducing anthropogenic impact on environment and climate, saving and conserving non-renewable sources of energy. The Energy Law was amended in 2007. Both laws based on Energy (2007) and RES (2010) enable the selling of electricity generated from RES to the grid.[6]

Barriers to small hydropower development

- Lack of reliable data on high potential and use of renewable energy;
- Low electricity tariffs;
- Uncertainty in the legal and regulatory framework for private sector participation or independent power producers;
- Monopoly of energy sector;
- Lack of financing and underdeveloped mechanism to both attract and manage resources effectively from donors or state-funded support for decentralized renewable energy development;
- Lack of local expertise in project development and maintenance of small hydropower stations and equipment;
- Lack of awareness on the potential significance of small hydropower technology to reduce winter energy insecurity and correlation of social significance associated with depleting forest wood resources for heating purposes.

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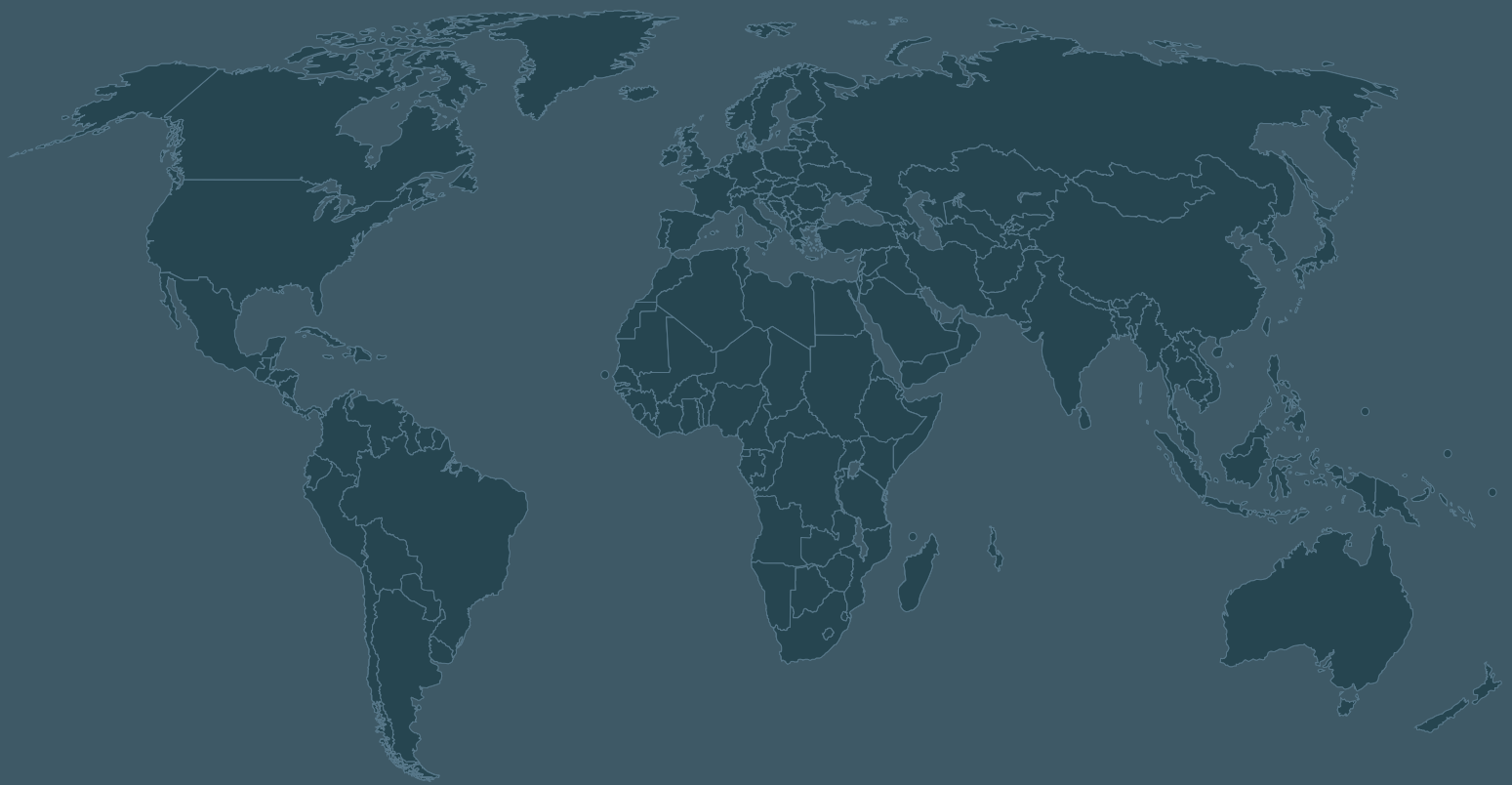
United Nations
Industrial Development Organization (UNIDO)
Wagramer Straße 2, 1220 Vienna
Austria

renewables@unido.org

International Center
on Small Hydro Power (ICSHP)
136 Nanshan Road, 310002 Hangzhou, Zhejiang
Province, China

report@icshp.org



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