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The Khudoni Dam:

A necessary solution to the Georgian energy crisis?

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Content

1. Executive summary

This report contends that the Khudoni dam is not a proper solution for the Georgian energy sector, through an analysis of the multifarious impacts of dam construction on ordinary people in the Georgian highlands. The report offers solutions by exploring alternatives and potentials for developing other sustainable energy resources.

Svan Types, 1881

The proposed 170 metre Khudoni HPP is planned in Upper Svanetia, an area of unique beauty and history, on the River Enguri. Construction of the dam will require the flooding of a number of unique villages (including Khaishi) and the resettlement of around 2000 Svans since ancient time.[1] It will also accelerate the devastation of the region, through the destruction of sub-alpine forests, meadows and wildlife habitat, the loss of river species populations and the degradation of upstream catchments areas owing to the flooding of the reservoir area in one of the most amazing highland regions of Georgia. The upper part of the River Enguri basin combines sub-alpine forests and meadows, rocks and alpine tundra, the area well known for its endemic wildlife – birds, mammals and amphibians.

The social impacts of the Khudoni dam construction will also be significant. Preserved by its long isolation, the Upper Svaneti region of the Caucasus is an exceptional example of mountain scenery with medieval-type villages and tower-houses, where people still continue to live based on mixture of ancient traditions and Christianity. The Svans, an ethnographic group of the Georgian people, are a race apart: the pace of life is different there, they have their own language and traditions, their own architectural styles, and for them ancient customs are still very much a part of everyday life.

The financing of the Khudoni dam – or any other large dam – does not represent effective investment for the Georgian power sector; rather it would lead its development along an unsustainable path. Due to the huge investments it will require a significant increase of tariffs if it will be used for domestic purpose, while for the majority of the Georgian population (around 50%) high electricity prices are already unaffordable. This has a direct impact on the health of the people, as it increases indoor pollution and drastically restricts the development of small enterprises.

[1]Archaeological, toponymic and linguistic evidence indicate that the ancestors of the Georgian people have inhabited the west-central part of the southern Caucasus region for at least 5,000 years and probably much longer. In the third millenium B.C. one group of Kartvelians migrated to the northwest, reaching the east coast of the Black Sea. Place-names believed to be of Svanetian origin are found in this area. Somewhat later, these ancestors of the Svans moved upland into what is now Svaneti. Axes and other artifacts—as well as the ruins of foundries for the production of bronze and iron—dating to the early Bronze Era have been discovered in Svaneti. This indicates that the local population was engaged in metalworking in the second and first millenia B.C. The Greek geographer Strabo (end of the first century B.C.) describes the Svans as a fierce, warlike mountain people, ruled by a king and a council of 300 elders and capable of fielding an army of 200,000. (This figure may be an exaggeration, or perhaps Strabo was including other Kartvelians under the designation "Svan.") Svans History and Cultural Relations, http://www.everyculture.com/Russia-Eurasia-China/Svans-History-and-Cultural-Relations.html

Khudoni construction would also significantly reduce the opportunities for critical evaluation of other investments for rehabilitation and construction of small- and medium-size HPPs, as all government focus would switch towards securing funds to complete Khudoni. as "The Main Directions of Georgian State Energy Policy"[2] and other strategic documents underline Georgia's potential to become an energy-exporting country and desires to construct huge HPPs directly connected to export possibilities, rather than for the satisfaction of local needs.

Furthermore if Georgia becomes an energy-exporting country it does not ensure automatic energy security. Even if Georgia were to export huge amounts of electricity and, in the best case scenario, it would support to generate high levels of income for the state budget, the majority of the population would continue to live in poverty and have limited access to electricity.

Ancient Svanetian Towers, X-XII century

Additionally, energy exporters would favour artificially high domestic energy prices that, while generating more revenues for exporters, would make energy availability for local populations prohibitively costly. This practice is not uncommon in the world, especially within poor countries.

Thus the main focus for the further development of the Georgian energy sector should be to provide and satisfy the demands of local populations as a way to ensure poverty eradication and economic development in Georgia. In line with the above-mentioned, the government of Georgia, as well as the international financial institutions, should ensure the sustainability of the power sector's development path through the attraction of investments for the rehabilitation of existing generating capacities, energy efficiency and the development of small local renewable (hydro, wind, solar) resources.

This can be done through:

1) conducting of a comprehensive Strategic Impact Assessment that would address the ways how to satisfy existing electricity demand in Georgia, with existing potentials and alternatives;
2) updating the "least cost development plan" for the Georgia Power sector, as well as study the accessibility to electricity for ordinary people and local industry;
3) developing and implementing a comprehensive energy efficiency development plan;
4) attracting investments for small hydro and wind through improved legislation and economic incentives.

[2] Published in May, 2006 www.min.energy.ge, and adopted June 7, 2006 by the Georgian Parliament

2. Introduction

Georgia still faces problems in the energy sector related to energy generation, its distribution and access to and affordability of energy sources. Unfortunately, the country still lacks the strategic policies and action plans that would direct the country towards sustainable energy development, increased energy security and ensured access to energy. Current efforts to develop a Georgian energy policy are chaotic and far from sustainable.

Map of Georgia. Location of the Khudoni dam

Due in part to the absence of a sound energy policy that is beneficial for society, the economy and the environment, decisions in the energy sector, especially in the power sector, are made on an adhoc basis. Additionally, notwithstanding some positive initiatives implemented by the government in recent years, ideas to construct large dams and even nuclear facilities continue to gain prominence. Further, the general public regards the construction of large hydro energy generation facilities as the easiest solution to the problem, and decision-makers aspire to turn Georgia into a large power-exporting country without addressing existing deficiencies at home.

The Khudoni dam project is one example that reflects these trends in the development of the Georgian energy sector. However, questions remain outstanding about the impacts of the Khudoni dam on the Georgian environment, its role in promoting socio-economic development and overcoming the main challenges facing the Georgian energy sector, as well as the true potential of the Khudoni dam to achieve real energy security, that accounts not only for energy supply but also access to energy. These questions need to be addressed by Georgian society before moving forward with the project.

SOME FACTS ABOUT SVANETIA

To the natural beauties, the snowy peaks, the flowers and forests of the Svanetian landscape, man has added something. It is a land where every man's house is his castle. The meadows and the cultivated valleys are strewn with high white towers. In one spot a single tower stands isolated, in another they cluster in groups of fifty to eighty

Douglas W. Freshfield, The Exploration of the Caucasus, 1896.

Svanety is one of the most beautiful and picteresque alpine regions of Georgia, situated on the southern slope of the main Caucasian range, its virgin waters cascading steeply downward from stunning mountains such as the twin peaked Ushba through glaciated highland valleys to the rivers Enguri, Kodori and Tskhenitsali.

The Khudoni dam will be located inside the Khaishi village, the gateways of Zemo Svaneti (Upper Svaneti). Surrounded by the highest peaks of the Greater Caucasus, the Upper Svanetia is the highest inhabited area in Europe. The landscape of Svaneti is dominated by mountains that are separated by deep gorges. Most of the region which lies below 1 800 metres (5 904ft.) above sea level is covered by mixed and coniferous forests. The forest zone is made up of tree species such as spruce, fir, beech, oak, and hornbeam. Other species that are less common but may still be found in some areas include chestnut, birch, maple, pine and box. The zone, which extends from 1 800 metres to roughly about 3 000 metres (5 904-9 840ft.) above sea level, consists of alpine meadows and grasslands. Eternal snows and glaciers take over in areas that are over 3 000 metres above sea level.

Preserved by its long isolation, the Upper Svaneti region of the Caucasus is an exceptional example of mountain scenery with medieval-type villages and tower-houses, and picturesque landscapes, with unique lifestyle. The famous Svanetian towers, erected mainly in the 9th-12th centuries, make the region's villages more attractive for visitors, while many towers remained with the dwelling houses and other facilities. There are around one hundred Georgian Orthodox churches, with unique frescoes paintings and icons; the churches preserve the unique samples of Georgian culture.

"Svaneti artistic creations of gold and bronze, copper and earthen wares, knitting and handicrafts give testament to its native ingenuity, encoding its myths of creation in folklore handed down from time immemorial, echoed in the plaintive strains of Svan music.

Svan gold panners using fleece[4]

In ancient times the Greco-Roman civilised world evinced great interest in Svaneti (witness the myths of Jason and the Golden Fleece [Colchis was the home of Medea and a special centre of sorcery. Strabo explains the legend of the Golden Fleece for which Jason sought by saying that the natives strained the gold from their mountain streams through fleecy skins.] and Prometheus and the Caucasus [Aeschyllus and Apollodoros described the location, appearance and dimensions of the double-vaulted mountain where Prometheus was bound, evoking highly symbolic images reminiscent of Svanetian mythology associated with Mount Ushba.]).[3]"

In the Caucasus mountains even today the Svan gold hunters use wooden pans and similar methods to recover gold. One of the common methods handed down from their ancestors is to place a sheepskin, fleece upwards, in the river or burn to catch the flakes of gold as they wash down. Strabo, the Greek geographer, recorded this method in the 5th century and this may well be the origin of the legend of The Golden Fleece[4].

Since 1996 the architectural monuments of Upper Svaneti have been included in the list of UNESCO World Heritage Sites. Zemo Svaneti still contains more than 200 of these renowned and highly unusual houses, which were used both as dwellings and defense posts against invaders who plagued the region in mediaeval times and before. Svaneti is also rich with its unique material culture created by Svan artists in gold and bronze (jewelry, war articles and etc_ , copper and earthen wares, knitting and handicrafts, that give testament to Svans 'native ingenuity, encoding Svan folklore and music that takes its pace since ancient time[5].

The Svans inhabitants of Zemo Svaneti, a group of ethnic Georgians, in their traditional life style a unique: daily they speak the Svan language (from the Georgian Language group), the ancient customs still continue as an important part of everyday life; this includes a mixture of paganism and Christianity, feud and hospitality. The pace of life is still different here from that of the modern world.

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[3] ***Shota Chartolani***, Head of Expedition of Svaneti, Doctor of Historical Sciences Professor, Center for Archaeological Research, ***http://members.tripod.com/centerarch/***

[4] http://www.leadminingmuseum.co.uk/Gold_History.htm

[5] One of the first data about Svans comes from Strabon, Strabo,–Strabzon's Geography, 1957. Published by T. Qaukhchishvili, Tb., 1957.

3. Khudoni Dam

3.1. Some facts about the Khudoni dam

The Enguri dam made a pool from the beautiful river, moisture ate the villages of Svan, walls were moulded and damped, onion and potatoes rotted in the land, apple on trees. Rheumatism made ill Svan's bones and children's' hearts. Looks like it was not enough for them, now they decided to construct Khudoni and flood Khaishi, while construction of other ones would mean to vanish all Svaneti!

Reaction of the Svans to a proposal by the Soviet government to construct the Khudoni dam.

The protest of the local population, the newly born national movement and civil society groups, combined with processes that lead to the Soviet Union's destruction, resulted in the construction of the Khudoni dam – started in 1979 – being stopped in June 1989. In 2005-2006 after the Rose revolution, the Georgian government actively started to seek investments in different circles for the Khudoni project; a huge promotional campaign to find public support has also been witnessed.

The proposed 170-metre Khudoni hydrological power plant (HPP) is planned for the high mountains of west Georgia, located two-thousand metres above sea level on the Enguri River. According to official calculations, the Khudoni HPP will require four to five years of construction with a total project cost USD 660 million, with an installed capacity of 638 MW, and will produce 1,445 TWh output annually. According to the Ministry of Energy of Georgia 25% of the works in Khudoni are completed and for finishing the construction works USD 500 million is necessary.

The project envisages the construction of an arch dam at crest with columns, with a height of 170 metres, including 141 arch parts. The project's length will result in a reservoir with a volume of 230 million cubic metres. The Georgian government also plans to complement the Khudoni dam with a number of other upstream hydropower plants located on the Enguri River (the Tobari HPP, with an installed capacity of 600 MW, projected generation 2,2 TWh, and the cascade of Nenskra HPPs, with an installed capacity of 87 MW).[6] According to project documentation for Khudoni, its construction will create the possibility for the Enguri dam (the third-highest arch-dam in the world at 270 metres, with an installed capacity of 1300m, located downstream of Khudoni), to generate an additional 1 TWh.[7]

In the 1960s, the Soviet Georgian government began construction of the hydro power station on the Enguri river (Enguri Dam). In parallel, a scheme for energy use on the middle part of the river was elaborated to ensure the full exploitation of the river's energy potential. The construction of the first hydro station on the Enguri started in 1961. Despite initial plans to construct the highest arch dam in the world (300 metres), the construction site and the length of the arch was changed (to 270 metres high), due in part to problems resulting from geological formations along the banks of the Enguri river[8]. To correct the mistakes in the initial planning process, another dam with an underground hydro station was slated for construction in Zemo Khudoni at an arched height of 200 metres[9], that has subsequently been reduced to 170 metres[10].

[6] The Georgian government also plans to construct a cascade of Namakvani HPPs on the River Rioni in west Georgia, with an installed capacity of 450 MW and an estimated cost of 700 mln USD; the Paravani HPP on the River Paravani in south Georgia with an installed capacity 120 MW; the cascade of Khrami HPP (3 units), with an installed capacity of 125 MW and number of other small and medium size HPPs.

[7] http://www.minenergy.gov.ge/index.php?lang_id=ENG&sec_id=62

[8] Problems related to maintenance of the Enguri Dam , can be seen in annex II.

[9] "Khudoni HPP was constructed to hide past mistakes", Akhali Versia, 21-23 July, 2006

[10] Khudoni HPP on Enguri River, Project documentation , 1992, research Institute "HydoProject"

From the beginning, these schemes were opposed by Georgian specialists[11]; according to their analyses, the geological and seismic conditions surrounding the Zemo Khudoni area were unsatisfactory. The specialists continued that Khudoni was proposed merely to mask the initial mistakes made during planning for the Enguri HPP by the USSR Hydro Project Institute. The specialists also worried that flooding at Zemo Khudoni would cause breaks in the rock formations along the left side of the river bank[12].

To mitigate the potential impacts during the construction of Khudoni, a concrete piling wall and check dam were projected and constructed. However, despite these precautionary measures, the specialists predicted that the wall and check dam would be easily destroyed in the case of seismic activities[13].

The Enguri gorge

Though initial construction on the Khudoni dam began in 1979, protests from local populations, civil society groups and the newly-christened national movement, combined with momentum from the impending dissolution of the Soviet Union, led to the stoppage of construction ten years later. In June 1989, according to a decree of the Georgian Cabinet of Minister, the dam construction was stopped.

At the same time, decree requests from the Academy of Science to prepare the list of the measures that would support restoration of ecological balance in Khudoni. Based on the works carried out by different scientific organisations and economic expertise[14], the Georgia Ministry of Energy and Fuel decided to continue to work to redesign the Khudoni HPP project, due to the fact that the restoration of ecological balance in the region according to them was impossible. The new

[11] Including the main engineer of the Enguri hydro station, A. Losaberidze, and the main engineer of the scheme for energy use along the middle part of the Enguri, P.Japharidze.

[12] Locals recall the facts of the falsification of the samples sent to expertise; according to them the geologists working that time for the dam construction took the samples of the rocks from other places in order to justify Khudoni construction. “Waiting conclusions for Khudoni construction”, Akhali Versia, 4-5 April, 2006

[13] “Khudoni HPP was constructed to hide past mistakes”, Akhali Versia, 21-23 July, 2006

[14] Despite all our efforts, we did not manage to receive the above mentioned documentations

version of the Khudoni HPP project was introduced in 1992. According to the project documentation all alternatives that "would avoid flooding of Khaishi village is not acceptable ecologically and economically", while the same document argues that "the impact of Enguri and Khudoni reservoirs on regional ecology and human health has local character and could not be considered as a major factor for the liquidation of construction"[15]. According to the project documentation a number of alternatives, including the Khaishi dam, have been considered during the redesigning of the project[16]. However, ultimately advantage has been given to the initial project with some changes: the reduction of the dam height from 200,5 to 170 metres to ensure that the plant and dam could withstand Richter scale earthquakes as compared to Richter scale 8 earlier[17].

In the period 1992 to 2003, the Georgian Government several times articulated that one of the main reasons for the energy crisis in Georgia was the halting of the Khudoni construction[18]. Following the 2003 Rose Revolution, the Georgian government actively sought investments from different circles and campaigned heavily to garner public support for the Khudoni project, with the Ministry of Energy declaring, "Khudoni will be constructed[19]"

According to current Georgian government estimates, the preparatory work for Khudoni construction is almost finished, including access roads, an operating discharge dam, a separating tunnel and substation. The government also contends that its inspection of Khudoni reveals that 25 percent of all works are completed, thus significantly reducing the construction costs in their calculations. However, independent experts have stressed the fact that all related infrastructure should be constructed once again due to the fact that exploitation terms for those objects have been passed away a long time before [20].

Major parameters of Khudoni HPP[21]

Total volume of water reservoir	230mln m3
Useful volume of water reservoir	89 mln m3
Height of the dam	170 m
Area of water table	24 km
Area of catchments basin	2800 km2
Length of hydro meteorological observation	48 years
Average annual ware flow	4100 m3
With (90 percent) provision	3600 m3
Average annual water discharge	130 m3/sec
Maximum discharge	850m3/ sec
Maximum discharge with 0,01 provision	2030m3 /sec
Maximum discharge with 1,0 provision	1030 m3/sec
Minimum discharge	14 m3/sec
Estimate discharge of the HPP	490 m3/sec
Estimated pressure of the HPP	143,8 m
Standard level of flooding	700 m
Depth of exploitation of the reservoir	55 m
Installed capacity	638 MW
Average annual generation	1,445 TWh
Hours of capacity usage	2400 h
Capital investments necessary for construction works	USD 660m
Cost of work to be done	USD 500m

[15] Khudoni HPP on Enguri River, Project documentation , 1992, research Institute "HydoProject"

[16] These alternatives are simply mentioned but not reviewed in project documentation, Khudoni HPP on Enguri River, Project documentation , 1992, research Institute "HydoProject"

[17] Khudoni Hydropwer Project, TOR for the preparation of Project definition, Feaibility Study nad Procurment, Ministry of Energy, Tbilisi, 2006 www.minenergy.gov.ge

[18] According to the initial Khudoni project documentation the Khudoni construction would take at least nine years, while the energy crisis started in Georgia in 1993 when gas consumption from Russia was cut.

[19] RadioTavisupleba, 14 March, Construction of Khudoni HPP – Reveal or way to ecological disaster, www.tavisupleba.org

[20] Khudoni Dam on River Enguri, Assignment for renewal construction, LTD Research Institute HydroProject, Tbilisi, 2006

[21] As planned by the Georgian government: www.minenergy.gov.ge

3.2. The World Bank's involvement

Beginning in the summer of 2005, the World Bank has been involved in negotiations with the Georgian government regarding the Khudoni HPP. The World Bank approved a technical assistance grant of USD 5 million for the Georgian government, of which around USD 1,75-2,35 million would be needed for preparatory works (preliminary and feasibility studies, technical studies, and an Environmental Impact Assessment (EIA) and Resettlement Action Plan (RAP)[22]). Among the various issues the project would address the issue of ownership of Khudoni HPP. Taking into account the energy generation facilities privatisation strategy implemented by the government, the fact that Khudoni HPP would be constructed under a state guarantee and even state subsidies may create quite a big misunderstanding.

According to the World Bank's Georgian Country Partnership Strategy[23]- belatedly revealed to the public only in late November 2005, the Bank proposed "under the possible IBRD enclave energy project (USD 50 million), the development of a new hydropower resource at Khudoni that could generate more than 10 percent of annual consumption and about 20 percent of current hydropower production, improving the security of Georgia's energy supply. The project would be structured as an export oriented sale of power to neighboring countries[24]".

The Georgian government fully understands that without World Bank participation it cannot find investors from financial markets for the Khudoni projects[25]; for this purpose, the World Bank has been asked by the government to create a financial consortium in order to secure funding for the hydro station building. The World Bank is considering partial financing for the project from the International Bank for Reconstruction and Development[26], with an electricity export contract guarantee up to USD 50 million and support for the mobilisation of private investments to support the Georgian government.

World Bank project documentation reveals that before construction on the dam continues, many outstanding issues need to be addressed; the technical-economic assessment and project preparation alone would require at least two years, and this timeframe could be expanded if expertise reveals that certain aspects of the Khudoni dam should change. According to preliminary examinations by World Bank experts, the USD 600m costs of Khudoni as defined by the government are an underestimate, and the basic scenario could cost USD 780m (i.e. +30 percent), with tariffs at – 4 US cents kWh, annual generation of 1,445 TWh and a five percent economic rate of return[27].

In addition to financing the technical-economic studies, the grant also provides funds to conduct an EIA and Resettlement Action Plan in line with the World Bank's Safeguard Policies. However, according to the Project Appraisal Document, a decision about what type and capacity of hydro station Khudoni is will first be decided and only then, when these most important decisions regarding project construction are made, should a Resettlement Action Plan and EIA be prepared. But to conform to World Bank policy 4.01, the EIA must contain clear assessments of alternatives and other options. As such, current project preparation design only allows the EIA to address mitigation measures, rather than to suggest clear alternatives to the Khudoni power station, in terms of alternatives to energy generation capacities, site location, dam and/or river run-off power plant stations, frequency (e.g. a number of smaller projects instead of one large project) and station design.

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[22] Infrastructure Pre-Investment facility, PO98950, www.worldbank.org
[23] Georgia Country Partnership strategy http://www.worldbank.org/external/default/
[24] ibid
[25] Companies to prepare Khudoni Project would be named in 2 months, 29-30 June 2006, Kvalindeli Dge
[26] Georgia represents an International Development Association country, the soft-lending arm of the World Bank Group
[27] Leaked World Bank letter to Minister Zurab Nogaideli, cited in newspaper "Akhali Versia", "Russian or European scenario – to be chosed by Georgian Government", 20-26 March, 2006

In spring 2006, the World Bank agreed to carry out a Strategic Environmental Assessment (SEA) of the Georgian power sector. The principle goal of an SEA should assess the existing potential of the power sector and support the Georgian government to formulate a sustainable energy policy and provide it with different scenarios to achieve this self-sustainability and energy security. However, the draft Terms of Reference for the SEA[28] stated that one of its main tasks "is to help clarify whether a Khudoni hydropower plant (based on preliminary cost estimates and safeguard assessments provided from other study work) would fit into a power generation expansion plan in such a way that using resources on a full feasibility study would be justified, costs and safeguard issues taken into account"[29].

While according to the ToR the consultant is obliged to elaborate scenarios for electricity demand through the year 2012, and prepare the least cost expansion plan and estimate indirect costs (such as dam safety, etc), it is simply required to provide "generic information on energy sources that is considered to be significantly more costly than hydropower" rather to make assessment of different alternatives (biomass, wind, geothermal, small scale hydro and etc). Another deficiency in the project design is that the SEA would be carried out not prior to project preparatory work but rather in parallel with it, along with the EIA, Resettlement action plan, and technical-economic studies.

3.3. A never-ending story: the fears and hopes of local people

Enguri, we would once again conquer you
Slogan of Communist Party on Khudoni construction site

Enguri, break irons and enjoy your century-old way
Svans' postscript after construction stopped

The construction plans of hydro cascades on the River Enguri presented the Svans with serious challenges to maintain their existing forms of cultural expression, especially as a result of displacement in the lowlands and the disappearance of dozens of villages. Khudoni construction will flood the village of Khaishi – "Doors of Svanetia," which is inhabited by around 80 to 90 families; but the flooding has broader implications, as Khaishi represents an administrative centre enlarged over tens of kilometres. Khaishi ***sakrebulo***[30] unites a number of villages and 500 families. The school, hospital and all other relevant facilities are located in Khaishi and the flooding of it will automatically be followed by the deserting of neighbouring villages – Tsvirsminda, Nankbuli, Vedi, Zeda vedi, Gagma Khashi, Datari, Idliani, Lukhi, Tobari, Jorkvali, Makhani.

3.3.1. Devastation in Khaishi

The visit to Svanetia began at the Khudoni construction site, and a number of locals provided guidance to highlight the dam's devastating footprint on Svaneti. Mountains were drilled and bored, the Enguri river bed has been changed and networks of tunnels have accelerated moisture penetration of the mountains and their slopes; mountain erosion is becoming frequent. In the spring of 2005, a huge mountain literally fell apart, trapping a river and resulting in the destruction of a bridge and the tunnel network. From Khaishi to Gagma Khaishi, another small village, people now are required to use a temporary bridge that, according to locals, will soon be washed away by the river. That creates quite a problem for the people of Khaishi and other villages to get access to hospital and other services.

The dam's foundation has also severely impacted the Enguri's flow. According to local populations, placement of concrete was planned to continue along the dam's hundreds of metres to retain the river's waters. But it never happened and the river waters are splashing away the dam's foundation. The Enguri River is disappearing under the bridge connecting

[28] Georgia's Power Sector: Strategic Environmental Assessment, Terms of Reference, Government of Georgia Ministry of Energy, Tbilisi, July 17, 2006
[29] ibid
[30] Local self governance

Khaishi to Gagma Khaishi, caused in part by a 100 metre-deep underground tunnel. Last spring this tunnel cracked; this year people also expect the same. Local villager Tamaz Kvirikadze explained that while there is no flooding yet this season, the tunnel already has a problem with water turnover. During flooding, water splashes out of the tunnel and could potentially destroy village houses, as Khaishi is only 30 metres from the dam construction site.

Locals are very concerned. Tamaz Kvirikadze noted: "Despite the fact that millions have been already spent it would be impossible to construct the dam cheaper. The works that have been taken already need to be redone and it would be more difficult now. The construction already changed the environment around and mountains are starting to fall apart. Before construction there were no springs and waterfalls. Now there is water everywhere and once it would flood us all." According to villager Oleg Jkadua: "There are some nuances that are impossible to restore. At least three years work would be needed to restore the site to the situation that construction could be continued." And these problems are further compounded by the penetration of the ground, mountain and its slopes with water.

The landslide on the Khudoni site

Engineer Rezo Zumadze participated in the construction of a sub-station near the Khudoni site. He remembers that in efforts to strengthen the substation's foundation, they were forced to drill more than four metres into very unstable and fragile rock. He recalls Khudoni construction and the falsification of facts in the rock analysis during Soviet times. According to Zumadze and a number of villagers, Soviet geologists had been sending falsified samples to Moscow in order to avoid construction stoppages.

"This was the Lord's wish to stop the construction," adds Tamaz, while Rezo recalls recent events: "If this dam would be constructed it would be the beginning of the end of Georgia. Last year different investors – Chinese, Japanese – already came here, but after testing the rocks never came back… During the construction there even was the need to cement the river banks to avoid victims among the workforce. After closure of Khudoni construction, different alternatives have been created that would bring less damage to people and environment, but why they again chose Khudoni that is connected with so many troubles?"

During the visit to Khaishi, a huge landslide was witnessed, when land masses and rock came down, blocking road entry to the village and destroying gardens along the banks of the Enguri. Following the landslide, villagers gathered in front of the ***Sakrebulo***[31] building. An owner of one garden was devastated, as she witnessed five years of work destroyed in an instant. Yet villagers have, since last year, come to expect landslides as quite regular events. In some cases, rains have not stopped for several days and landslides occurred throughout the region, blocking roads in many places for several hours. One woman shared her story about a landslide directly in front of her house. Upon hearing a terrible noise and seeing the mountain start to crumble, she immediately took her children and ran from the garden. Now, their house is inhabitable, and the family must seek refuge with relatives. Yet it is unclear where her family will live in the future and whether the Georgian government will provide any support.

[31] local self elected unit

3.3.2. Resettlement

It is better to be here than in Tbilisi

10-year-old Khaishi villager Gela Meshveliani, on the prospect of resettlement

Most villagers are against resettlement and prefer to stay in Khaishi; memories of resettlement during the periods of construction on the Enguri and Khaishi dams are still painful. Isak Kardava remembers construction on the Enguri dam: "The resettlement started in June 1949. It was really hard to watch: all juniors and adults had cried, as they would forever leave their motherland, graves of their fathers and grandfathers, houses that remember centuries of history. The village had been abandoned, left alone for foreigners to destroy and demolish everything. It was the beginning of construction on one of the highest dam in the world that flooded 30 kilometres around the village and upwards of 200 metres of forests, villages, and grazing areas. The region where once upon a time the life was enjoyable stayed without itssons." Kardava fears that he will witness another disas-ter if the Georgian government completes the construction of the Khudoni dam; only the names of the flooded villages would be different, while the result would be the same – misery.

Khaishi villagers are extremely vulnerable to Khudoni construction. Having once experienced resettlement and managing to return to their homelands, villagers have little desire to repeat the process again: "The village was set up and resettled, but the conditions in the new place were terrible, mountainous people had been relocated in the desert, where drinking water was a mirage and houses were constructed in a way that would fall apart in few years. I also had house there but could not withstand those conditions and went back"- says Nanuli Sumbadze. Her house was destroyed during these years, and she warns, "If they are preparing the same for us again, they should know that it will be impossible to start construction. We will stop it by all means".

Tamaz Kvirikadze recalls: "These hydro [power plants] psychologically and morally destroy our people. In Soviet times, they pushed us not to work and create something here. For constructing houses, they punished people and excluded them from the communist party. But what then can people can? They have families and need shelter. How long would grand, grandfather's house stand? Half of the century has passed, and see how the village looks, how people live in misery and houses are destroyed. If we are speaking about compensation, the calculation of the damage should start from 1976. But if we will leave this place, we will end up in a worse situation. Someone could become greedy and would be cheated, but we already experienced on our shoulders all lies and what comes with it. I'm 41 years old and according to my memory, every time [the government] lied to us. All life goes on with the fear about the village being or not being, and now even I would sacrifice my life for it. Running away would not help us. We should improve our life here where we are living."

Meri Fridonashvili remarks that her family is tired of living in fear, worries made manifest by the huge boulder in front of her family's home. She despises these conditions but does not know any alternatives; in spite of a number of natural disasters as, floods and erosion that devastated her land and home, the government has yet to provide assistance.

An old woman named Mzia Jkadua also related her story of losing both land and garden: "Now I'm old and who will support me? Now I'm living in two rooms of the local hospital and will agree to resettle from here, but I have no more hope any more".

Venera Davitiani also shares her worries about resettlement. "It is not possible to reach my house neither by car nor by horse. We need normal conditions where we leave. Everybody I need lives in the village and I have no desire to leave. If there were better conditions, Khaishi would be the best place in the world. The village is destroyed because during the years there were discussion about [Khaishi's] existence and until now nobody has taken care of the village. Two years ago the ***gamgebeli***[32] of the Mestia region was appointed and still he makes no effort to meet us; I'm not speaking about people from Tbilisi."

Khaishi village being or not to being

In spite of systematic natural disasters, such as floods and landslides, deplorable road conditions and inadequate living standards, some Svans feel that resettlement is the only solution. For these residents, any means to increase their wealth and chances for survival are acceptable, including construction of the Khudoni dam. Yet they remain quite skeptical about the renewal of construction, and these Svans blame central and local governments for ignoring their plight and suspect that the government will again forget about the Svans once the outstanding issues of Khudoni are resolved.

3.3.3. Corruption

During the construction periods of the 1980s on the Enguri and Khudoni dams, Khaishi villagers witnessed vast corruption associated with the sale of project materials. The former prosecutor of the Mestia region, Isaak Kardava, noted large amounts of graft related to the sale of "construction materials from Enguri - bricks, timber and others; in all of Georgia, settlements and cities have been constructed [with these materials]". Kardava speaks of huge violations during the construction of the Enguri and Khudoni dams during Soviet times. Around 200 people had been arrested for misuse of construction materials. However, at that time first secretary of the Communist Party of Georgia, Mjavanadze, stopped all trial cases.

The cemetery that would be floded

The construction materials were also brought to upper Svaneti, but because of limited demand, the materials were not sold and subsequently discarded directly on the roads. Even today, one can see the abandoned concrete blocks from Enguri construction on its way to Khaishi. Yet for Svans these materials were not useful, since the Khudoni dam has forced villagers to leave their homes, not construct new ones. As another villager, Soso Zumbadze, noted, "In those times, bureaucrats made lots of the money at the expense of Khaishi and other villages and now they want it again".

[32] Appointed chair of local governance unit

3.3.4. The decision-making process

The local peoples' greatest concern is that decisions about the future of Khaishi have largely been decided by outsiders, irrespective of local wishes or their participation in and knowledge about the decision-making process. This view was frequently reiterated during the meeting arranged by villagers to discuss the revival of Khudoni Dam construction. As Khaishi villager Mzia Chkvimiani stated, "If everything is for public, first they should ask the same public. When they decide to take the loan [for Khudoni HPP] , this would be again the burden on the people's shoulders… Before you sit somewhere and bring the verdict against the people, ask the same people what they think, what ails them and why". Her neighbour Jumber Jkadua reinforced this sentiment: "Nobody will resettle from here. When water will flood everything around, I will stay here. If they are willing to sink a village with people, they could construct hydro. What do they want from us? There are better places up from the village, where they can construct hydro with less costs, there would not be any need to flood our village or to cut our forest, destroy the churches and disentomb the graves, and arrange doomsday for us."

During the meeting both villagers in opposition and even some supporters of the dam decided that its construction was unacceptable given that the decisions regarding the future of Khashi were made by bureaucrats from Tbilisi without local input to the decision-making process. A special commission on Khudoni dam construction was established during the meeting, which elaborated a first appeal to the President of Georgia. Its statement[33] underlines that despite television and newspaper reports, no government representative had met with local people to explain the situation regarding the dam's construction and thus effectively limiting local villager's rights to participate in the decision-making process. The statement requested that the president and relevant ministries to send representatives to the region and provide explanations of the process. Despite the number of the requests from the local population to involve local stakeholders in the decision-making process, till now people's concerns had not been shared (see Annex 1 and 2).

One villager, former lead specialist of the Enguri mechanisation processes, Nikoloz Zumadze, feels that the current situation everywhere in Georgia is dire but he also sees that the Georgian government is reluctant to address the problems of its people. "Why I should read on the television screen a running script, that 'World Bank gives 3,2 million to Georgian government for construction'; and why the villagers of Khaishi should not get this information from their own government during the face by face meeting ".

Giorgi Korguani, chairman of Etseri Temi, [34], notes that, "During the Enguri construction there were lots of mistakes made and corruption flourished, this time it should be different. Yes, people would get some jobs for a certain time, but afterwards they might also loose things they had before the construction. And what does it mean to me if energy is not consumed in Georgia and if its price also goes up? You are increasing for me the tariff on electricity, cutting my forests, penetrating my house, taking away my lands, supporting natural disasters, creating huge risks. And why? We need the construction that will bring welfare, economic development and social insurance for the people. These are the conditions set up by Georgian people."

The Svans fear that, as a result of construction on the Khudoni and Tobari HPPs, the Svanetia will disappear as unique geographic and cultural phenomena. As one Svan, Soso Zumbadze, expressed, "If I would leave Khashi, why would I need life? All my ancestors have graves here. I should leave those graves alone and resettle? What type of person would I be in my further life? If humans have no beliefs, he is not a person." Together with his neighborus, Zumbadze is concerned about preserving the unique cultural heritage of Svanetia: "This land contains ancient history. Look at what treasures from Svanetia is contained in our museums, part of them found in our village".

[33] Statement "Don't make decision about us, without us" to President of Georgia Mr. M.Saakasvili, Minister of Energy Mr. N.Gilauri, Minister of Environmental Protection and Nature Resources, Mr.G.Papuashvili, 13-19March, 2006, Akhali Versia

[34] Local self elected unit,

The majority of Svans consider the possibility of constructing a number of small hydro stations on the Enguri in Upper Svanetia more profitable, less costly and likely to avoid the flooding of villages. According to Nikoloz Zumadze, "The Enguri falls makes possible the construction of three dams in Khashi territory, and these dams would not flood the village and destroy environment."

3.3.5. Environmental impacts

For visitors to Zemo Svaneti, it is evident that the region faces problems related to the sustainable use of its natural resources – unique flora and fauna, forests, and natural monuments. One problem contributing to resource degradation in the area is increased rural poverty, which has increased wood consumption for fuel, as well as illegal logging for export. Another problem is overgrazing and deforestation, which promotes increased soil degradation and erosion, significantly contributing to the frequency of natural disasters such as floods, landslides and avalanches that damage the environment and destroy economic infrastructure. And over the last decades, drastic climate change has noticeably impacted the surrounding environment. The trend goes towards increased temperature in Svaneti in comparison with the first half of XX century up to 0,90 C, with increased annual precipitation up to 14% and humidity rate[35]. The global warming process also negatively affects the glaciers, causing them to melt and retreat, and the further intensification of this process is expected that would lead towards the disappearance of small ones.[36]

The saw-mill in former worker's camp

But the main problem facing the natural resources of Zemo Svaneti is the ongoing deforestation that has resulted from the ill-conceived Khudoni dam construction scheme. Dam construction has necessitated an access road, high buildings and a workers' camp. According to locals, Turkish enterprise-owned sawmills export huge volumes of timber from Svanetia.

Until now, a large portion of Zemo Svaneti's mountain forests have been conserved in a pristine state, providing shelter for rare native plants and animals. The mountain forests of Zemo Svaneti serve a protective function for surrounding ecosystems. But this protection is jeopardised as logging on mountain slopes stimulates landslides and floods. The situation is catastrophic in some areas, where deforestation from uncontrolled logging has caused soil erosion. The residents of Zemo Svaneti face real dangers as ecological resources become increasingly scarce and already some groups of Svans are forced to resettle in other regions as ecological refugees.

According to some estimations "the amount of timber cut per year exceeds 120 000 m3 and some 1200 hectares of woods are depleted, while no adequate programs for reforestation and regeneration of forests are implemented to preserve them for both present generation and those to come".[37]

[35] The Climate Change in Kvemo Svaneti and its impact on natural and anthropogenic systems, Second National Communication preparation team, UNDP/GEF and Georgian Government joint project 2006, Tbilisi,

[36] April is the cruelest month , A combination of global warming, unstable geology and heavy rains leaves much of Georgia vulnerable to springtime natural disasters, http://enrin.grida.no/proceedings.cfm?article=30

[37] Report about "Initialization of a Tourism Info Center Mestia" or How to support SME-development in Zemo Svaneti?, Georgian Mountain Federation, supported by GTZ, www. www2.gtz.de/wbf/doc/GMF_Zemo%20Svaneti_report_GTZ_public.doc

The Khudoni HPP will intensify the devastation of forests and wildlife habitat, the loss of river species populations and the degradation of upstream catchments areas as a result of the flooding of the reservoir area in one of Georgia's most ecologically-diverse highland regions. The upper River Enguri basin combines sub-alpine forests and meadows, rocks and alpine tundra, an area well known for its endemic wildlife. These species includes different forest birds, a community of large raptors (golden eagles, griffon vultures and lammergeyers), and other endemic birds that include the Caucasian black grouse, the Caucasian snowcock and the Caucasian chiffchaff. Mountain goats, chamois, brown bear, wolf, lynx, roe deer, and wild boar are quite common.

The landslide on the main road

The cumulative impact of the Khudoni, Enguri and Tobari HPPs will also adversely affect water quality, natural flooding and species composition in the river. Changes to the river's course have also resulted from the construction of underground dam facilities. An associated problem is related to the underground tunnel, as it is important to close it and take lockouts to bring river in old bed, to avoid the natural lock of tunnel (by sediments) that could lead to flooding in Svaneti and further downstream.

4. The Khudoni dam and energy security in Georgia

The Georgian government portrays the Khudoni dam as a major step towards domestic energy security, while according to the World Bank: "The project would be structured as an export oriented sale of power to neighboring countries"[38]. Indeed energy security is an important issue, but it would not exist if energy is not accessible to local people and local business. Furthermore it is likely that Khudoni and other large HPPs planned by the government will increase the electricity tariff, while local industries based on old technologies characterised by high energy capacity will lose their competitiveness. It should be also highlighted that there are no credit lines or state programs in Georgia designed to support local industries that implement energy conservation and efficiency measures.

The privatisation of energy facilities and the attraction of foreign investments for constructing new dams was one of the reasons for the increase of the electricity tariff in the spring of 2006. The part of the tariff rate increase were closely connected with Russia's increase in the price of gas (from 62USD / m3 to 100 USD / m3) in December 2005, however, the underpinning objectives were also to attract investors for the privatisation process[39].

It should be mentioned that in his presentation "Investment opportunities in the Energy Sector of Georgia" in Istanbul in February 2006[40], the minister of Energy underlined that the main reason for investing in Georgia's energy sector is the "inexpensive hydro electricity for local consumption and export", while "domestic tariffs" are increasing. With increased tarrifs the Ministry also hopes that it would be two solutions in one: cover higher costs and decrease

[38] Country Partnership Strategy, World Bank, 2005

[39] "Investment opportunities in the Energy Sector of Georgia" Istanbul, February 2006, Minister of Energy of Georgia Nika Gilauri, www.minenergy.gov.ge

[40] "Investment opportunities in the Energy Sector of Georgia" Istanbul, February 2006, Minister of Energy of Georgia Nika Gilauri, www.minenergy.gov.ge

demand. According to the Khetaguri deputy minister, "We have a deficiency in the system in the winter time," he said. "To eliminate the deficiency there are two ways: to increase the production and to decrease the demand. And the high tariffs and the step tariffs will somehow push the customers to consume less."[41][42]

The Enguri dam

It is expected that with huge investments in the energy sector, the Khudoni dam will also increase the electricity tariff, considering that the costs of electricity produced from HPPs in Georgia are around 0,5 – 1 US cents per kWh, and preliminary calculations by the World Bank show that electricity from Khudoni would cost 4 US cents per kWh, while economic return internal rate would be only 5%.

According to the pre-feasibility study for Khudoni, carried out by Core International, "the essential economic result of this analysis is that Khudoni HPP, Georgia's biggest hydro power plant, could be financed if it were sold largely to the export (regional market), and/or if generation prices within Georgia were substantially higher than at present."[43] One more important aspect: politicians and decision-makers often discussed the new hydro within Georgia "as if providing "export capability" while simultaneously presumptively providing inexpensive internal hydro. It can not simultaneously both. If the capacity is exported it is not available for internal use. But also, the capital costs for new hydro must be paid, and are comparable to the current average unit cost of imports. Thus the principal effect of building new hydro within Georgia would be to increase Georgian internal capability, thus increasing "supply security" in that sense"[44].

But increasing the "supply security in that sense" does not solve a number of problems attributed to the Georgian Power Sector, and its impact on the Georgian population, environment and economy.

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[41] http://www.eurasianet.org/departments/business/articles/eav060906.shtml

[42] It should be highlighted that according to World Bank research 2002, envisaged that poorest strata in Tbilisi, has been consuming only 105 kw per month, that is already very small amount taken into account the fact that most of the household technique (as refrigerators, TVs and so on) is inherited from Soviet time. While using the more cheap energy as fuel-wood and kerosene to substitute its daily energy needs (especially for districts which are not supplied by gas). (www.) Increase of the electricity prices in mid 2006 mostly hit the rural population, with the price increased by 66% per kwh.

[43] http://www.coreintl.com/projects/current/Ministry_of_Energy_Republic_of_Georgia/Strategic_Planning_Capacity_Building.html

[44] ENERGY BALANCE" OF GEORGIA POWER SECTOR, PART 1: ANALYSIS AND PROPOSALS, Page 6 of 172, CORE International, Inc, www.minenergy.gov.ge

If the Khudoni dam will increase the electricity tariff due to huge investments in the energy sector and is to become an economically viable project for internal use, it should be remembered that people living near the Enguri HPP, Georgia's largest hydro project that accounts for 40 percent of Georgia's electricity consumption, already experience problems with access to energy. High electricity tariffs are already unaffordable for a majority of the Georgian population; more than 50 percent of the population is living under the poverty line, while extreme poverty affects 17.4 percent of the population [45]. Khudoni's significant effects on the electricity tariff will further harm the livelihoods of a majority of Georgian people.

The concerned Khaishi villagers

Khudoni construction would also significantly reduce the opportunities for critical evaluation of other investments for rehabilitation and construction of small- and medium-size HPPs, as all government focus would switch towards securing funds to complete Khudoni. "The Main Directions of Georgian State Energy Policy"[46] and other strategic documents underline Georgia's potential to become an energy-exporting country and desires to construct huge HPPs directly connected to export possibilities, rather than the satisfaction of local needs.

And Georgia becoming an energy-exporting country does not ensure automatic energy security. Even if Georgia were to export huge amounts of electricity and, in the best case scenario, if it would support the generation of high levels of income for the state budget, the majority of the population would continue to live in poverty and have limited access to electricity. Additionally, energy exporters would favour artificially high domestic energy prices that, while generating more revenues for exporters, would make energy availability for local populations prohibitively costly. This practice is not uncommon in the world, especially within poor countries.

Thus the main focus for the further development of Georgia's energy sector should be to provide and satisfy the demands of local populations as a way to ensure poverty eradication and economic development in Georgia.

5. Why Khudoni is not an option?

From the beginning the intention behind the construction of Khudoni was to provide peak power for Southern Russia and its neighbourhood countries.[47] Thus Khudoni could become an attractive project in the case of the existence of a reliable market for its peak power in neighbourhood countries. The World Bank also considers the Khudoni project as a source for electricity export from Georgia and will allocate money only under an electricity export contract guarantee, that will enhance Georgia's role in the regional energy trade. In this case it is not clear how the project would contribute towards the eradication of existing problems in Georgia with regards to energy security and the accessibility of energy.

[45] World Bank Country Assistance Strategy, 2005, www.worldbank.org
[46] Published in May, 2006 www.min.energy.ge, and adopted June 7 by the Georgian Parliament
[47] Shall we build Khudoni or not?, T.Mikashavidze, M Margvelashvili., Newspaper "24 Hours", No.57 March 14 2005 , www.weg.ge

Georgia already has quite a large power generation system that consists of hydro and thermal electric power, while the total installed capacity for 2003 accounts for 4 700 MW, where from 2 700 MW is hydro and 2 000MW by thermal power plants, due to the lack of financing since 1990, the actual capacity is lower. In 2005 the overall generation was 7,1 TWh, of which 72% was generated by HPPs.

The "Georgia Least Cost Development Plan"[48] financed by USAID in 1998 aims to assist the government of Georgia to define a capital investment plan for the power sector through the year 2010. The results of the planning model were quoted for two scenarios of economic development : Slow Growth (base case) scenario and the modified Strong Growth scenario.

The study clarifies that the most immediate needs of the Georgian power system involve the restoration of its large and medium hydro electric power stations, and the repair and strengthening of the high voltage transmission system.[49] Projects like Khudoni or Tkibuli Coal power units turned out to be less economical for meeting the expected electricity demand than other projects available in the system.

Since 1998 a number of significant changes took place in the Georgia Electricity sector, including the explosion of the 300 MW Gardabani Unit 10 in 2002, the installment of new power units in 2005, as well as rehabilitation carried out on a number of small and medium size Hydro power stations, and Enguri dam. Also economic development has been much slower than the base case scenario reviewed in 1998 study, not to mention a number of assumptions, as e.g. collection rates are much lower, and other realities that needs to be reflected in the planning of the future of the Georgian energy sector[50].

Before putting money into the pre-feasibility and feasibility studies, the right approach should be to ensure the development of a new "Least Cost Development Plan"; a comprehensive assessment would address the ways in which to satisfy existing electricity demand and ensure the solution of the energy problems in Georgia, with existing potentials and alternatives. Both documents would give potential for reasonable decision-making, including the definition of an energy policy and a strategy for the country rather than a political decision to become an energy exporter.

The study "Energy Balance of the power sector of Georgia", conducted in 2006, argued that

"Georgia should prefer use of hydro power, to natural gas, as a source of electric generation for most domestic purposes", the "analysis of hydrological conditions shows that this can be a feasible solution, even in low water conditions. Reliance on hydro would minimize domestic requirements for external sources of natural gas, and thus increase energy security for the country". While the study reviews a number of scenarios for must run versus least cost dispatch basis, it assumes and reviews only cases with planned construction of Khudoni and Namakhvani HPPs (450 MW installed capacity HPPs cascade on Rioni river); it does not review other alternatives (including energy efficiency, wind and small hydro projects, that have already been adopted by the government) for the substitution of the costs of import of electricity and gas for power generation from abroad.[51]

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[48] Implemented by Burns & Roe Enterprises Inc

[49] Shall we Build Khudoni or not? T.Mikashavidze, M Margvelashvili,.,Newspaper "24 Hours", No.57 March 14 2005 , www.weg.ge

[50] Some assessment of the scenarios has been undertaken in the report "A Natural Gas Strategy For Georgia", 2006, implemented by USAID, as advisory assistance to Ministry of Energy. It also recommends rehabilitation of existing HPPs.

[51] However, as it is underlined, "the present study does not claim to be a complete "energy strategy", nor an analysis of particular trading partners, contract terms nor recommendation for dispatch of particular units at particular hours.
concentrates on two principal issues. First, we analyze the capability of Georgia to operate as a predominantly hydro-power based system, and the risks in adopting that strategy. Those "risks" include possible benefits, in form of additional generation capacity, of a particular sort. Thus, second, when combined with the analysis of possible export capacities, our study finds a surprising conclusion: Georgia may be able to export not just energy, but "reliability" as a separate and defined service". "ENERGY BALANCE" OF GEORGIA POWER SECTOR, PART 1: ANALYSIS AND PROPOSALS, Page 6 of 172, CORE International, Inc, www.minenergy.gov.ge

It should be underlined that the Georgian energy sector has a large potential to ensure that the country's energy systems are both sustainable and secure. This could be done through enormous energy efficiency possibilities and the development of local, decentralized renewable energy generation systems.

According to the World Bank project appraisal document, the decision on what type and capacity hydro station would be constructed is to be taken at the end of the second phase. However, here we will try to underline a number of Khudoni alternatives based on the specifications given by the government of Georgia: 638 MW and costs up to USD 500 million. As an alternative to Khudoni, as well as a number of the large dams planned by the government of Georgia,[52] we have considered three options:

1) the rehabilitation of existing small, medium and large hydros,
2) the construction of small hydropower stations and wind farms,
3) energy efficiency.

6. Alternatives to Khudoni

6.1. Rehabilitation of existing hydro capacities in Georgia

The rehabilitation of all HPPs in Georgia will add a significant amount to the generation capacity of Georgia, while representing a very cost-effective approach to restore Georgia's power sector capability[53].

Nowadays, HPPs contribute more than 70 percent of Georgia's annual power balance. Full installed capacity of HPPs up to the end of 1990 was around 2800 MW[54]. The medium and large hydro technical capacity amounts to 81TWh per year[55]. However, even in 1989 (the maximum annual power generation registered[56]) the hydroelectric power stations of Georgia worked out at only 8,7 TWh . The USAID least cost analysis done in 1998 highlighted that rehabilitation of existing generation capacities of Georgia, especially HPPs, would be the most cost effective approach.

Currently only a third of Georgia's existing HPPs are in use. While the rehabilitation of medium- and large-HPPs is ongoing, only a small number of small, state-owned HPPs have been rehabilitated in the last few years[57]. Yet for many regions of Georgia, energy from small HPPs is vitally important and sometimes the only source of energy. Because of the poor conditions of small HPPs, in most cases these same regions experience the heaviest energy crises. In the early 1990s, as a result of low prices during privatisation, owners lacked the necessary capital and capacity to properly rehabilitate the already damaged HPPs. Many small HPPs were stopped fully, others were sold as scrap. In spite of this the government did not provide assistance during the process.[58]

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[52] Other than Khudoni, the Georgian government also plans to start in 2008 the construction of Cascade of Namakvani HPPs on the Rioni river. The plans already includes the governmental plan for the implementation of EU Georgia Action Plan, and a number of other documents. The system of the Namakhvani Hydropower Plants, with installed capacity of 450 MW and 1674 mln kw/h annual generation, is located in the west of Georgia and is intended for power transmission to the United Transcaucasian System. The middle course of the Rioni river is planned to be used by three Hydroelectric Power Plants (Tvishi, Namakhvani and Zhoneti), which will be built between the lower pool of the Lajanuri Hydro and upper pool of the Gumati HPP. According to the government it has already received agreement from the government of Kuwait for the provision of USD 700 million for all three HPPs' construction. Another construction for large HPPs to be started in 2008, according to the governmental plan, is envisaged in South Georgia, on the river Paravani, with installed capacity of 120 MV and average annual generation is 442 mln; the derivation type Paravani plant will be constructed.

[53] The "Georgia Least Cost Development Plan" financed by USAID 1998,

[54] The classification of hydros in Georgia is the following: large hydro (over 100 MW, 50% of whole installed capacity), medium hydro (2-100MW, 35%) and small hydro (below 2 MW, 15%). Since September 2006, the small HPPs definition has been reclassified and now small hydro is below 10 MW.

[55] 75% of those

[56] www.gse.com.ge.

[57] These include the Chirukhi-Sanalia, Kazbegi, Atsehydro, Bjujahydro, and Kekhvi HPPs.

Though information about the number and roster of small HPPs in Georgia is difficult to gauge[59], estimates we have found suggest that the total capacity of the already existing HPPs that need rehabilitation is around 200 MW – enough to cover the energy requirements of most rural households and small- and medium-sized enterprises. The rehabilitation costs for small hydros are quite modest, e.g. for around eight small and mini HPPs, UNDP and GEF have estimated up to 5 million USD. [60]

There are 26 large and medium size HPPs in Georgia. The majority of HPPs have been privatised over the years. However, almost all the privatised as well as state HPPs need to be rehabilitated, and currently all the HPPs are operated at only 40-45% of their installed capacity.[61]

The rehabilitation of the HPPs will increase the safety of operations on the one hand and the generation output on the other. It should be underlined that during the power generation privatisation the rehabilitation requirement was included only in the case of some particular hydros[62], while for others this requirement was not stipulated.

Although the rehabilitations require quite a considerable amount of funds, all the same the rehabilitations cost less than the construction of new dams. The rehabilitation of three units and significant works to ensure dam safety for Enguri HPP in 2006, increasing its actual capacity from 800 MW to 950 MW, cost up to EUR 50 million. It is expected that through additional 10-20 million euro investments the rehabilitation of Enguri Dam and an additional two other units will be undertaken. That gives the possibility to increase Enguri HPP's actual capacity towards a projected 1300 MW in 2008.

The Enguri river in irons

Another large state HPP that requires rehabilitation is the Vardnili HPPs cascade. The installed capacity of Vardnili I, located downstream of Enguri, is 220MW, while operational capacity is 110 MW; the 120 MW Vardnili II-IV HPPs are fully flooded and not functioning.

The generation capacity that will be available in the case of the rehabilitation of the existing HPPs is significant, and exceeds Khudoni's generation capacity.

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[58] One of the main obstacles for small HPPs was the legal requirement prohibiting the direct sale of power to users. Under the law, small HPPs have been requested be involved in the state electric system, and the right to sell their production was limited to the Georgian wholesale energy market. While the system of cost recovery was not regulated and in most cases small HPP enterprises receive only 17 percent of the revenues from sold energy, which was not sufficient for the proper functioning of the station, the purchasing of spare parts or rehabilitation works. In effect, small enterprises have difficulties assuming economic risk and securing financial backing from banks, even in the cases of very low interest rates. Changes to the legislation introduced in the summer of 2006 have reclassified the definition of small HPPs, opening the possibility for construction without state licenses, which some consider a step forward. The owners of a small HPP were also given the right to sell electricity directly to users as of September 1, 2006. However, there is still a need for strict environmental assessment procedures and controls to avoid situations in which developers try to construct small- and medium-size HPPs on protected or designated natural areas.

[59] Annex 1. List of small HPPs around Georgia

[60] Debt-for-Environment Swap in Georgia: Potential Project Pipelines for the Expenditure Programme, PART TWO OECD, 2006

[61] The perspectives of usage of renewable energy resources in Georgia, L.Tavartkiladze, Georgian Strategic Research and development Center, bulletin N90, 2005 ,

[62] http://www.ebrd.com/projects/psd/psd1998/4304.htm

The list of large and medium size hydros in Georgia[63]

	Large and Medium Hydros in Georgia	Installed Capacity (MW)	Existing Capacity (MW)	Generation output in 2006 (GWh)
1.	Enguri	1300	950	1741,1
2.	Vardnili	340	110	342,5
3.	Jinvali	130	70	401,65
4.	Lajanuri	112	30	290,4
5.	Khrami I	113	113	344,7
6.	Khrami II	110	35	118,8
7.	Dzevrula	80	50	112,6
8.	Rioni	49	49	291,7
9.	Vartskikhe I-II	184	145	746,9
10.	Gumati	67	50	228,9
11.	Shaori	40	27	65,5
12.	Zahresi	30	16,9	169,1
13.	Ortachala	18	7,2	94,6
14.	Athesi	16	6,2	71,6
15.	Khador	24	24	128,7
16.	Satskhnesi	14	?	46
17.	Chitakhevi	21	?	109
18.	Bzhuzha1-3	12,24	?	48,9
19.	Tetrikhevi	13,6	?	29
20.	Sioni	30	?	?
	Total	2726,66	1731	

6.1. Construction of new small hydros and wind farms

Among Georgia's natural resources, hydrological energy takes prominence. All research dedicated to the development of small hydro in Georgia has underlined that huge possibilities existed in the country that could also be beneficial from the environmental perspective. In Georgia there are more than 26 000 rivers – around 60 000 kilometres in length – and the energy potential of the main 319 rivers has a total annual energy capacity equivalent to 1563 GW[64] ; It should be mentioned that the first HPP with a capacity of 103 kw was built in Borjomula village, in 1898. In the 1960s, approximately 300 small, mini and micro plants were functioning in Georgia. These plants provided electricity to the regions, small enterprises and farms. But the establishment of centralised electricity production in the following years suspended the operations of the majority of hydro plants.

The number of different assessments undertaken by USAID, UNDP, GEF and others has highlighted the potential for development of small hydro energy. "The analysis of more than 300 rivers of Georgia shows that it would be possible to construct 1 200 derivation type small hydropower plants, of which 700 could be built in western Georgia. The total installed capacity of these plants would equal 3 000 MW, of which 2 000 MW could go to western Georgia, with an annual generation of 16 000 GWh (11 000 MWh in western Georgia"[65].

[63] The list here is not full and the data is taken from different sources that includes data of Georgian State Electrosystem and Ministry of Energy. There could be small deviations taking into account some rehabilitation works carried out for some HPPs, however we try to incorporate all new information that comes from the ministry. However, for some HPPs, e.g. Sioni HPP, it was impossible to find any official data with regard to actual output, despite the fact that it is functioning and Sioni Dam rehabilitation is intended under the WB/MDC funds.

[64] Power Resources of the USSR. Hydropower Resources. A.N.Voznesensky et al., 1967

[65] Until the middle of 2006, one of the main obstacles for small HPPs' rehabilitation and the construction of new ones was the legal requirement prohibiting the direct sale of power to users. Under the law, small HPPs have been requested to be involved in the state electric system, and the right to sell their production was limited to the Georgian wholesale energy market. While the system of cost recovery was not regulated and in most cases small HPP enterprises receive only 17 percent of the revenues from sold energy, which was not sufficient for the proper functioning of the stations, purchasing of spare parts or rehabilitation works.

According to the assessment carried out by UNDP and GEF in 2002, the construction of 50 mini HPPs with total installed capacity of 26 MW will cost USD 35 million, while it also would support decentralised energy supply in rural areas, where people use mainly wood for cooking, heating and hot water and, for lighting, kerosene. If the small HPPs were to operate in isolated networks, the losses in the transmission network that vary from 5 to 14 percent in Georgia will also be significantly decreased.

Changes to legislation introduced in the summer of 2006 have reclassified the definition of small HPPs (up to 10 MW), opening the possibility for construction without state licenses, which some consider a step forward. Owners of small HPPs were also given the right to sell electricity directly to users as of September 1, 2006[66].

In spring 2006 the Georgian government came with plans to construct around 30 HPPs, on the Rioni, Kura, Tskeniskali, Khrami, Chorokhi, Gubazeuli and other rivers. The tender was opened for construction works on around 32 small- and medium-HPPs, with a total installed capacity of 511,5 MW[67]. The bidding was not successful as, according to experts, "the technical capabilities of listed hydro power stations do not correspond to the real energy generation capacities of the rivers"[68]. However, experts estimated that it is possible to develop around 20 small HPPs (up to 10MW) with total 130 MW installed capacity and the costs would be up to USD 144 million, based on the government's plans.

Together with small HPPs, the Government of Georgia has bid for the development of 10 wind farms for 20-40 MW in spring 2006, while it plans to create conditions to develop up to 1200 MW installed capacity in wind energy all around the country. Wind power also represents one of the significant potentials for the development of renewable energy in Georgia, with an estimated average annual outcome of 4,5 TWh technical potential, or almost half of Georgia's current consumption.

Georgia's energy potential is divided in four zones:

- high wind speed zones, including the high mountain zone of the Great Caucasus, the Kakhabery lowlands and its central district, where the working term of wind farms is more than 5000 hours per annum;
- low speed and partially high speed wind zones including the Kura river valley, the south Georgian (Javakheti) highland and the Black Sea Coastal zone, where the working term of wind farms is 4500-5000 hour per annum.
- low speed wind zones with possibilities of efficient exploitation of wind farms including the Gagra pass, Kolkhety lowlands and the lowlands of eastern Georgia.; and
- low speed wind zones, with restricted possibilities for efficient exploitation of wind farms, including the Ivory highland and the Simony reservoir.

The studies for wind regimes in these territories have already been completed, based on years of meteorological data and direct measurements from modern, high-accuracy meteoantennas. A number of prospective construction sites for wind farm stations have been identified:

The main characteristics of wind farm stations

Place	Capacity in MW	Annual production of electricity (GWh)
Poti	50	110
Chorokhi	50	120
Kutaisi	100	200
Sabueti Mountain	150	450
Sabueti –Mountain	600	2000
Gori-Kaspi	200	500
Paravani	200	500
Samgori	50	130
Rustavi	50	150
Total	**1450**	**4 160**

[66] According to experts there is a need for adoption of the law on small hydro that will give the possibility to join the European Small Hydro Association and operate under its guidelines. "How to become Energy exporter country?", Rezonansi, 19 April, 2006

[67] Among these: in Guria on the Bakhvistkali and Gubazeuli rivers; the Chelo River in Kakhetia; in Svanetia on the Nenskra River ; in Kvemo Kartli on the Khrami river; and in Samtskhe-Javakheti on Lake Paravani.

[68] "How to Become an Energy Exporting Country", newspaper "Resonance" 103, April 19, 2006

6.2. Energy efficiency

Energy consumption has significantly dropped in Georgia since the country became independent. However, this was caused by an actual drop of energy consumption, rather than structural changes in the economy, possible fuel switching and significant progress in energy efficiency as happens in stable economies. Unfortunately, the overall energy efficiency assessment still has not been done; energy intensity in the Georgian economy and households remains high.[69] This should not be surprising, taking into account the fact that the general industry sector as well as households are using mainly equipment inherited from Soviet times. In addition, it should be highlighted that the industry sector accounts for only about 14% of total final consumption, while the residential sector for about half of it. The actual collapse of the industrial sector makes it quite problematic to assess the consumption developments in the end-use energy efficiency in Georgia's industrial sector[70].

While the "Main Directions of Georgian State Energy Policy" acknowledges energy efficiency as one of the main priorities, the strategy does not assess the potential of energy savings, nor does it offer any concrete proposals to develop this area further. As such, funds allocated for energy efficiency measures are scarce or nonexistent. Yet energy efficiency measures and technologies could significantly reduce energy consumption by industry and the general population[71]. Meanwhile, according to some experts, "Crude calculations suggest that the increase of energy efficiency in supply and consumption sides by just 10 percent, will lower the dependence of the country on imported energy resources by approximately 20 percent. [72]".

7. Conclusions and recommendations

The financing of the Khudoni dam or any other huge dam does not represent effective investment for the Georgian power sector; rather it would lead it towards an unsustainable development path. The construction of the Khudoni dam would not solve the problems of Georgia's power sector, while it could accelerate the devastation of one of the most beautiful and unique regions of Georgia.

The problems of the sector are not mainly due to a deficit of generation capacity, but instead are more due to problems of power sector management, maintenance of infrastructure, energy efficiency and losses in transmission lines. Taking into account the potential of Georgia's power sector to be developed in a sustainable manner, the growth of energy consumption and the energy balance structure should be planned based on the use of local, mainly hydro and wind resources, which would be based on the principles of sustainable development.

The Government of Georgia, as well as the international financial institutions, should ensure the sustainability of power sector's development path through the attraction of investments for the rehabilitation of existing generating capacities, energy efficiency and the development of local renewable (hydro, wind, sun) resources.

This can be done through:

1) conducting a Strategic Impact Assessment that would address the ways how to satisfy existing electricity demand in Georgia, with existing potentials and alternatives;

2) updating the "least cost development plan" for the Georgian power sector, as well as a study on the accessibility to electricity for ordinary people and local industry;

3) developing and implementing a comprehensive energy efficiency development plan and;

4) attracting investments for small hydro and wind through improved legislation and economic incentives.

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[69] In-depth review of Energy efficiency policies and programmes, Republic of Georgia, Energy Charter Secreataria, 2004

[70] In-depth review of Energy efficiency policies and programmes, Republic of Georgia, Energy Charter Secreataria, 2004

[71] With only minimal optimisation of transformer capacities and working regimes, it would be possible to save 4 million kw/h annually for lighting big cities 6-7 million kw h, around 30 million kw/h in water supply systems, and 40 million kw h for water -tower regimes, USAID Least Cost Study 1998;

[72] "Crude calculations suggest that the increase of energy efficiency in supply and consumption sides by just 10 percent, will lower the dependence of the country on imported energy resources by approximately 20 percent." Georgia in the context of EU energy policy, Teimuraz Gochitashvili, Professor;, Mindaugas Krakauskas, GEPLAC expert on energy issues, George Abulashvili, GEPLAC expert on energy issues Georgia Economic Trends, June 2006 www.geplac.org

[73] http://www.dams.org/docs/kbase/thematic/tr31main.pdf

Annex 1. Statement of Khaishi villagers 2007

To: President of Georgia, M. Saakashvili

Minister of Energy, N. Gilauri

Minister of Environment Protection and Natural Resources, D. Tkheshelashvili

World Bank office representation in Tbilisi

March 2007

Dear Sirs

The construction of the Khudoni HPP has been stopped more than a decade ago, based on the outcomes of the expertise. However nowadays the Georgian government has declared it to be a priority project that addresses the state interests. The inhabitants of Khaishi village are following the process of decision-making with regard to the project and the existence / resettlement of the village only through the press and the media. Up to now neither central nor local government representatives have visited the village to explain the situation; nor has our opinion regarding the issue been asked for.

If Khudoni dam construction is a priority for the country then the villagers of Khaishi should be taken into account; for the villagers of Khaishi, the Khudoni NPP construction is a matter of life and death that our government for sure does not take into account. The uncertainty of the situation that has continued for several decades has brought the village towards destruction. Bearing in mind the Soviet experience, despite the same would be unacceptable for a country claiming democratic governance, the people start to speak about widely known cases overnight resettlement .

It is known that some foreign companies have expressed their wish to fund the NPP's construction and the World Bank has already financed preliminary works. For the last few months some works have been underway, but up to now it is unclear what will be our fate. The different state entities have already been abandoned; there are the rumours about the abandonment of a secondary school. All of these push us towards the conclusion that the conditions for the abolishment of one of the most strategic villages for Zemo Svaneti and Zemo Afkhazeti are underway.

There is the impression that the World Bank standards do not include local stakeholder's interests and the funds that have been given for preparatory work do not involve the very few amounts that could be disbursed to provide us with information. If it is not true, in this case it is our government that violates international standards.

We demand to the representatives of state entities that are involved in Khudoni construction, that Khaishi Sakrebulo, the units around ten historic villages, and the people living their have their constitutional and internationally recognised rights. Together with the fact that Georgia has an international obligation to protect historic and cultural property that has been maintained till now by us and our ancestors.

We demand information on what are the obligations of the government vis-a-vis local communities during the implemen-tation of similar projects and when the implementation of these obligations is supposed to start.

Sincerely,

Inhabitants of Khaishi village

Signature of 78 Khudoni inhabitants

Annex 2. Statement of Khaishi Villagers 2006

To: President of Georgia, M. Saakashvili
Minister of Energy, N. Gilauri
Minister of Environment Protection and Natural Resources, G. Papuashvili

March 2006

Statement

We have become aware that the Georgian government plans to restore the construction of Khudoni HPP, involving the unconditional resettlement of Khaishi population. No one from official structures, neither from central nor local ones, has visited us to discuss the issue of resettlement and the only information we have is from the media. This raises doubts that the project will be implemented against our interests. It is unacceptable to speak about the resettlement of people that have no information about it.

On March 10, 2006 in Khaishi a public meeting was arranged, that decided to create and register a commission that will be comprised of elected representatives of Khaishi residents. The commission will cooperate with governmental and non-governmental entities to protect the constitutional rights of the local population and to create the legal background for any project that may be implemented.

Meanwhile, we should underline that some newly created organisations in Tbilisi are speaking with the government on behalf of Khaishi residents. Their representatives have never had any meeting with us, not to speak about the fact that they have no permit to speak on behalf of Khaishi villagers. The Khudoni construction first of all attributes to Khaishi villagers and any decision concerning the village should be taken with our involvement.

We would like to ask you to send your representatives as soon as possible to the village of Khashi in the Mestia region, to give us information about the possibilities of the Khudoni HPP construction.

Sincerely

The members of commission with regard
to Khudoni HPP construction

Annex 3. Enguri dam

According to project documentation for Khudoni, its construction will create the possibility for the Enguri dam (the third-highest arch-dam in the world at 270 metres, with an installed capacity of 1300m), to generate an additional 1 billion kw / h. It is also projected that the Khudoni dam will regulate water transmission in the Enguri reservoir. The Enguri dam became temporary operational in 1978, and completed in 1987. In spite of this, already in 1994 three engineers from Hydro-Quebec that inspected Enguri dam, found the world's third highest dam "in a rare state of dilapidation"[73]. One of the main problems often attached to huge dams – the problem of maintenance – is fully revealed in the case of Enguri. The total costs of the Enguri dam rehabilitation according to the EBRD are around EUR 116 million.[74]

Due to the problems related to quality of design and construction, together with the non-existence of the funds for its maintenance, the dam has experienced major problems, including the flooding of the turbine galleries from water leaking through the concrete arch, a falling stoplog, a "defective[75]" spillway and each. However, since the Soviet Union fall Enguri Dam annually was supplied Georgian energy system with 30% -45% of all electricity generation.

Taking into account the country's acute energy crisis in 1998, the EBRD allocated USD 40 million for Enguri's rehabilitation, although most of the works were carried out without switching down the power station thus prolonging the repair work. As a result by 2006 only a few repair works were done. Additionally the EC allocated EUR 9,6 million for Enguri dam rehabilitation. In winter 2006 the decision was taken to switch the Enguri and dewater the reservoir for the next six-nine months. The Enguri dam was shut down for reparations in March 31, 2006, and the reservoir's dewatering together with subsequent heavy rains caused flooding in a number of villages downstream.

In October 2006, the rehabilitation of the third aggregate (generator) of the Enguri power station was completed and it became operational. In total, there are five aggregates at the Enguri facility. This power station has the capacity to generate 1 300 MW of electricity-260 megawatts (MW) times its five hydro units. On average it generates 3,8 TWh according to the Ministry of Energy's data. Over the next two years, its is planned that the first, fourth and fifth hydro units will be restored again through the new 10 million EURO credit support from the EBRD, as well as expected enlarged grant support from the European Commission and USAID.

It should also be highlighted that the villagers situated on the Enguri river in the downstream region of Tsalendjikha have for a number of years complained about the hydropower station's impact on the region, including an increase in landslides and swamp areas, and the villagers have requested the establishment of a governmental commission to investigate these issues. However, these requests have never been taken into account, which may also be due to the fact that there was a scarcity of funds for the rehabilitation of the dam itself.

[74] http://www.ebrd.com/projects/psd/psd1998/4304.htm
[75] http://www.dams.org/docs/kbase/thematic/tr31main.pdf

Annex.4. List of small HPPs to be rehabilitated in Georgia

N	name of HPP	district	date	river	installed capacity in kWh	Total Energy ProductionMl n kw h	installed capacity kw/h	number of turbines	state of HPP	Turbine type	tariff cost tetri/kwH
1	2	3	4	5	6	7	10	11	12	13	14
1	Ritceula	Ambrolauri	1967	Ritceula	6056	31	5100	3	b	p	3
2	Orbeli	Tcageri	1951	Lajanuri	440			-	nw	f	
3	Zvareli	Oni	1947	Kheora	218			2	nw	p	
4	Abasha	Abasha	1928	Abasha	2150	11	6200	3	m	f	3
5	Chkhorotcku	Chkhorotcku	1967	Tekhura	4000	25	4600	2	m	f	3
6	Ghoresha	Kharagauli	1937	Kvataura	50			1	m	p	
7	Dashbash	Tsalka	1936	Dambashis tckaroebi	1260	9	1500	3	m	f	3
8	Dmanisi	Dmanisi	1935	Mashavera	400	3	7500	2	m	k	3
9	Ortatchala	Tbilisi	1949	Mtkvari	18000	90	5000	3	m	k	3
10	Chitakhevi	Borjomi	1949	Mtkvari	21000	109	5100	3	m	f	2.2
11	Alazani	Gurjaani	1942	Alaznis arkhi	4800	20	4100	2	m	f	2.8
12	Tiriphoni	Gori	1951	Tiriphonis arkhi	3000	14	4600	2	m	f	3
13	Misaktcieli	Mtckheta	1964	lamis-misaktc	2780	13	4600	2	m	f	3
14	Kakhareti	Adigeni	1957	Kvabliani	2080	12	5700	2	m	f	3
15	Igoeti	Kaspi	1953	Tezi-Okami	1765	11	6200	2	m	p	3
16	Kabali	Lagidekhi	1953	Kabali	1500	9	6000	3	m	f	3
17	Kekhvi	Gori	1941	Liakhvi	980	5	5100	2	nw	f	3
18	Khertvisi	Akhalkalaki	1950	Tapharavani	294	2	6800	2	m		2.4
19	Shatili	Dusheti	1974	Shatilis-tckali	264	2	7500	2	nw		2.8
20	Sioni	TianeTi	1964	Oiri	9000	33	3600	2	m	f	2.8
21	Satckhenisi	Gardabani	1952	Samgoris	14000	86	6143	2	m	f	3
22	Martkophi	Martkophi	1953	"----------"	3800	14	3684	1	m	f	3
23	Tetrikhevi	Martkophi	1953	"----------"	13600	49	3600	2	m	f	2.6
24	Ats hesi	Khelvachauri	1937	Acharis tckali	16000	97	6000	2	m	f	2.6
25	Bjuja	Ozurgeti	1957	Bjuja	12240	63	5100	3	m	f	2
26	Sokhumi	Sokhumi	1948	Aghmos. Gumista	19053	102	5300		no	f	3
27	Kinkisha	Kobuleti	1954	Kinkisha	740	4	5400		m	f	3
28	Machakhela	Khelvachauri	1956	Machakhela	1430	9	6200		m		3
29	Achi hesi	Kobuleti	1958	Achis tckali	1028	8	7700		m		2.4
30	Jirkhva	Gudauta	1962	Jirxva	2100	12	5700		no		
31	Bagnari	Gagra	1950	Nakaduli	1600	11	6800		no		
32	Duriphshi	Gudauta	1954	Belaia	1600	10	6250		no		
33	Gagra	Gagra	1938	Djeokvava	800	4	5000		no		
34	Psou	Gagra	1956		500	2	4000		no		
35	Besleti	Sokhumi	1909	Besletka	368	2	5400		no		
36	Ritsa	Gudauta	1949	Lashiphse	984	5	5000		no		
37	Adjara	Gulriphshi	1963	Djeokvavia	170	1	5800		nw		
38	Mestia	Mestia	1936	Mestiachala	100	0.4	4000		nw		
39	Chala	Mestia	1939	Kala-chala	84	0.3	3500		nw		6.3
40	Becho	Mestia	1938	Dolura	1300		1300		nw		
41	Khazbegi	Khasbegi	1951	Snos-tckali	280	1.6	5700	2	nw		
43	Endzela	Akhalkalaki	1995	Pharavani	400	3.4	7000	2	g	b	
44	Khadori	Akhmeta	2001	Alazani	700	700	21	2		f	O.N
45	Jurchula	Sachkhere	1999	Jurchula	500					b	5

N	name of HPP	district	date	river	installed capacity in kWh	Total Energy ProductionMln kw h	installed capacity kw/h	number of turbines	state of HPP	Turbine type	tariff cost tetri/kwH
46	Suramula	Khashuri	1999	Suramula	109	0.434			G	b	6
47	Dzama	Kareli	1952	Dzama	250						3
48	Arbohesi										3
49	Intsoba	Kakheti	1997	Intsoba	1550		2200				6
50	Skuri	Samegrelo	1958	Chamistckali	500		2100				3
51	Mashavera	Shida kartli	1956	Mashavera	600		690				5
52	Tarashvili			Mtkvari	500		600				6
53	Mekvena	Racha			150		1100				3
54	Chirukhi-sanalia				3000		1300				
55	Kindzmarauli-khana	Akhmeta	1996	Sartcu arkhi	1500		600		G		6
56	Munleuk-georgia	Tkibuli			150		1100				3.6
57	Rustavi	Akhaltcikhe	1998	Mtkvari	999	8,759		1		f	4.1
58	Khana-II	Baghdadi	1950	Khanistckali	300						
59	Phshaveli	Phshavi	2005	Stori	500						
60	Okami	Okami	1999	Ksnis s/a	1600						
61	Lipota	Telavi	2001	Lophota	2000						
62	Tamarisi	Marneuli	1957	Khramis s/a	400						
	Total				**187772**						

Map legend

Turbin Type : Francis - F, Kaplan - K , Pelton -P, Bank -B peltoni-p, banki-b

state of HPP : Good - G, Medum -m, non-working -nw, bad -b, no info - no