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Hydro in Georgia: Undeveloped Potential



The Case for Demand

- Georgia has one of the largest hydropower potential capacities in the world at about 32 TWh per year. At present only 18% of this capacity is harnessed
- As oil prices continue to surge worldwide, hydropower is becoming an increasingly attractive alternative energy source
- Currently, the weighted average cost of Georgian hydropower needed to produce one KWh of electricity is US\$0.027 - half the cost of thermal generation - which costs approximately US\$0.06 per KWh
- In 2007, Georgia will for the first time become a net exporter of energy, well-positioned and fully able to meet growing demand from energy-importing countries
- Continued domestic demand growth for electricity will be accompanied by strong foreign demand, especially from Turkey – the primary foreign consumer of Georgian electricity – where end tariffs are among the highest in Europe
- Electricity distribution companies in Georgia are under private management and are operating at a net profit
- Georgia's electricity transmission network is already connected to Turkey, Russia, Azerbaijan and Armenia

| Energy indicators | 2006 | 2007F |
|---|-------|-------|
| Energy balance, TWh | | |
| Consumption | 8.3 | 8.6 |
| Local production: | 7.8 | 8.3 |
| Hydro | 5.6 | 7.1 |
| Thermal | 2.2 | 1.1 |
| Import | 0.5 | 0.4 |
| Annual consumption per capita, KWh | 1,890 | 1,955 |
| Annual hydro potential per capita, KWh | 7,273 | 7,273 |

Strong Government Support

- The Georgian government has expressed a strong formal commitment to expanding hydro generation capacity in coming years; a series of reforms has sent a strong signal to both end users and potential investors

Ownership Advantages

- Georgian hydropower offers potential investors unique ownership advantages in hydro not available elsewhere: Newly built hydro power stations in Georgia will remain the exclusive property of prospective investors, whereas in many countries with rich hydro potential, a BOT (Build, Operate, Transfer) scheme is typically used
- The system operator in Georgia - ESCO - guarantees purchase of all electricity from newly- built hydros, thus minimising the off-take risk
- Under current legislation, prospective investors are permitted to negotiate returns directly with the Georgian electricity regulator before committing to an investment. Potential returns are up to 20% p.a.

Future Feasibility

- In cooperation with the Georgian Ministry of Energy, the Nordic energy consultancy firm ECON is undertaking a detailed due diligence and feasibility study that will assess the investment opportunities in greenfield hydropower sites in Georgia. ECON is also developing pre-feasibility studies for key prospective sites (1,600 MW in total)
- It is expected that the due diligence and pre-feasibility studies will be made publicly available to prospective investors in October 2007



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The Georgian Hydropower Sector

Georgia has the highest per capita hydropower potential in the world, higher than the world's hydro leaders - Norway and Canada

Unique Hydropower Potential

Georgia has one of the largest undeveloped hydropower potentials in the world at about 32 KWh per year.

There are 26,000 rivers in Georgia; of these only 12% are used for hydropower generation. Georgia's two largest rivers, the Mtkvari and the Rioni, flow in opposite directions. The Mtkvari, which originates in Turkey, generally runs eastward through Georgia and Azerbaijan into the Caspian Sea, while the Rioni drains into the Black Sea to the west. Most of the country's hydro resources are concentrated in Western Georgia.

The gross theoretical hydropower potential of Georgia is 139 TWh/year, of which 68 TWh/year is technically feasible. However, only approximately 32 TWh/year is economically viable. Currently only about 18% of this economically viable potential has been developed.

The economically viable share of hydropower potential includes that from the Enguri River (31.7%), the Rioni River and its branches (23.2%), the Kodori River (16.7%), the Alazani of Tusheti River (10.2%), the Mtkvari River and its branches (10.4%), the Bzipi River (4.6%), and other remaining rivers (3.2%).

Georgia's potential hydropower production is roughly 7.27 MWh per capita, which is considerably higher than that of the world's biggest hydropower producers, Norway and Canada, which produce 5.4 MWh and 3.3 MWh, respectively.

Increasing hydrocarbon prices contribute to hydropower becoming more attractive

Attractive Cost Structure

As the cheapest source of electricity generation, hydropower has become increasingly attractive due to surging hydrocarbon prices in Georgia and worldwide.

Currently, Georgia's weighted average cost of hydropower required to produce 1 KWh of electricity is US\$0.027. The average cost for gas and coal fuelled power plants is considerably higher, especially with increasing fuel prices worldwide: Russia, which has traditionally been the main supplier of gas to Georgian thermal stations, quadrupled gas prices since 2005 to US\$235 per 1000 m³, increasing the cost of thermal generation to approximately US\$0.06 per KWh.

Growth Potential

Continued growth of domestic demand in the Georgian energy market will support further growth in hydropower generation.

With energy consumption growing at 8-9% annually - which is well above the European average - Georgia has a fast-growing energy market. However, the per capita consumption is still among the lowest in Europe and thus further strong consumption growth is expected.



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Energy Sector Improvement

Georgia has a transparent and commercially orientated energy market system.

Georgian electricity distribution companies are under private management, and technical and commercial losses in the system have been dramatically reduced in recent years to acceptable levels. Distribution companies are now operating at a net profit.

A series of reforms, which has improved commercial viability in the sector, has sent a strong positive signal to potential investors.

The acquisition of two distribution companies and six generating companies by the Czech energy producer Energy-Pro in 2006 confirms foreign investor interest in Georgia’s robust energy potential.

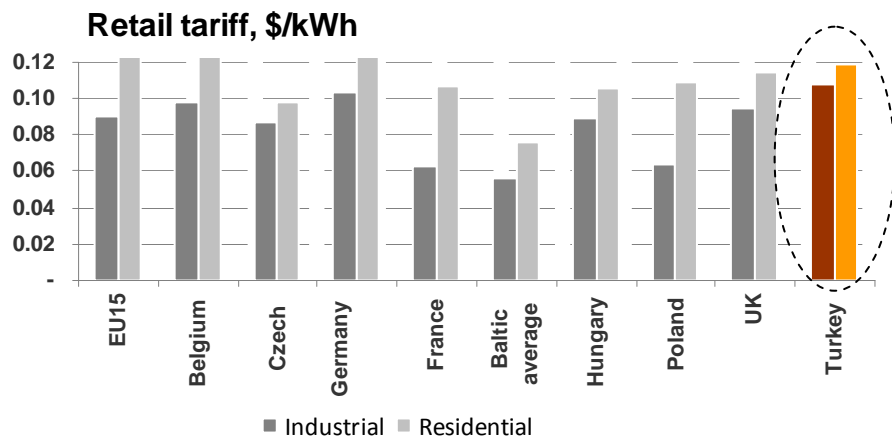
Export Potential

Georgia’s electricity transmission network is already connected to Turkey, Russia, Azerbaijan and Armenia. Turkey, which is the primary export market for Georgian electricity, has one of the highest wholesale electricity tariffs to industry in Europe and rapidly growing demand.

Significant export potential to Turkey exists due to high tariffs and demand growth

In Turkey the electricity consumption has been growing at 7% CAGR for the last 15 years.

In 2006, Turkey’s tariffs were US\$0.11 per KWh for industrial consumers and US\$0.12 per KWh for residential consumers, which are among the highest in Europe. The average wholesale tariff of locally generated energy in Turkey is about US\$0.052 per KWh.



Over the course of the last decade, Turkey has imported electricity from Bulgaria, Azerbaijan, Iran, Georgia and Turkmenistan – with the majority being from Bulgaria. Georgia’s authorities have announced an intention to sell energy to Turkey at a price of at least US\$0.055 per KWh. With the average cost of hydro generated energy of only US\$0.027 per KWh, and a transmission cost to Turkey of US\$0.0062 per KWh, the export potential appears significant.



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The government is committed to expanding aggressively Georgia's hydropower generating capacity

Strong Government Commitment

The Georgian government has expressed a strong commitment to expanding aggressively hydropower generation capacity in coming years. As an expressly stated strategic priority, the government intends to replace expensive thermal electricity generation with hydro. The government also wants to facilitate the export of electricity to neighbouring countries and meet rapidly growing domestic demand.

Hydroelectric generation will continue to play a major role in Georgia's energy plans for the foreseeable future, primarily because of favourable hydrological conditions. The Ministry of Energy is currently continuing its overhaul of power plants and is also seeking lenders and investors for new construction.

Currently the country's largest hydroelectric project involves construction of a 640 MW plant at Khudoni on the Enguri river about 30km upstream from the Enguri dam. The second most important generation project is the construction of the Namakhvani power station, which will have installed capacity of 450 MW. Pre-investment studies will be prepared both for Namakhvani and Khudoni as part of the project undertaken by ECON.

There is also a sizeable project involving development of a 500 KV voltage transmission line Gardabani TPP-South Georgia-Zestaphoni-Enguri HPP, connecting power systems of Georgia and Turkey. In addition to the larger, aforementioned plant projects, another 80 small hydropower projects with a total capacity in the order of 350 MW are being pushed forward.

Ownership Advantages

Newly built hydropower stations in Georgia will remain the propriety of the investor, whereas in many countries with rich hydro potential, BOT schemes are typically used.

Many prominent hydropower projects are operated under Build, Operate, Transfer schemes (BOT). However, in Georgia, investors will have full ownership of the facilities they build.

Hydropower is likely to draw the interest of energy-intensive industries

Hydropower as a Basis for Industry Expansion

Due to low generation costs, hydropower plants are likely to attract industries in which energy is one of the primary production costs.

Being a primary source of energy for some types of production, cheap energy is likely to attract energy-intensive industries (e.g. aluminium smelting, electrochemicals and petrochemicals) to the areas near hydropower plant location.

We expect this to create a 'virtuous circle' of sorts, with low energy costs attracting energy-intensive industries, which in turn will drive further demand.



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Future Feasibility

Detailed studies of hydropower potential by ECON should be available in fall 2007

- In cooperation with the Georgian Ministry of Energy, the Nordic energy consultancy firm ECON is undertaking a detailed due diligence study of the investment opportunities in Georgia's hydropower sites. ECON is also developing pre-investment studies for key prospective sites (1600 MW in total).
- The due diligence will have separate studies assessing political (local and regional) risks, the general investment climate in Georgia, the electricity sector in the country and export markets for electricity. The study will focus on the risks and returns for international investors assessing the potential of Georgian hydropower.
- The pre-investment studies will provide extensive financial calculations, including but not limited to capital expenditures, operating expenditures, expected internal rates of return and cash flow profiles for each of the surveyed sites. The document will also present low-cost technical designs for prospective sites, hydrological profiles and evaluations of the potential for industrial development set to benefit from the cheap electricity provided by the project.
- The due diligence and pre-feasibility studies are expected to be made publicly available to prospective investors in October 2007.
- A road show is planned where the Georgian hydro-power sector will be presented. The presentations will be held in October-November 2007 at major European destinations, including London, Vienna, Stockholm, Copenhagen, Oslo and Helsinki.
- An investment conference will be organised in Tbilisi in early 2008 for interested investors.



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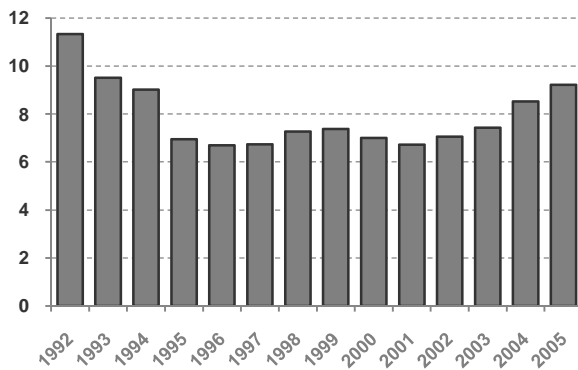
The Georgian Electricity Sector

Consumption

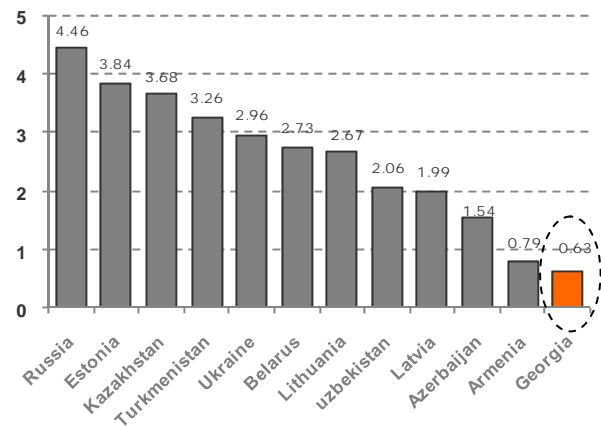
Though constantly growing, per capita energy consumption in Georgia is still low in per capita terms

Georgia has a fast growing energy market. Electricity demand grew by 9.8% and 8.4% in 2004 and 2005, respectively. These growth figures are well above the EU average and, combined with low levels of per capita consumption, are an indication of the potential of the sector. Moreover, even with energy consumption forecast at 8.6 TWh in 2007, Georgia's consumption is still lower than that in the 1990's, which suggests even further scope for growth. This potential increase is further supported by the fact that with ratios of 0.73 tons of oil equivalent (toe) as ranked by GDP, and 0.63 tons of oil equivalent as ranked per capita, the Georgian economy is one of the least energy-intensive economies in the CIS.

Georgian energy consumption dynamics



Energy intensity by country toe/per capita



94% of Georgia's 8.3 bn KWh of electricity consumption is generated domestically

Energy Balance

Peak energy consumption in Georgia is 1,640 MW. While the annual electricity consumption totalled 8.3 TWh in 2006, only 94% (7.8 TWh) of it was covered by local generators. The remainder was and still is imported (0.5 TWh) from Russia, Azerbaijan, Armenia and Turkey. Georgia currently exports electricity to Turkey and Russia.

The government has undertaken effective restructuring of the electricity sector. It is expected that with further investment in hydropower generation and the completion of upgrades to high voltage lines to Turkey and other neighbouring countries, Georgia will become a net exporter of electricity later this year.

High voltage lines connect Georgia to Turkey, Azerbaijan, Armenia and Russia.

The generators sell electricity to the wholesale market operator, who is in charge of dispatch, transmission and payment control

Industry Structure

Currently Georgia uses a 'pool' system, whereby generators sell electricity to the wholesale operator in the Georgian electricity market - the Electricity System Commercial Operator (ESCO). Distribution companies then purchase the electricity from this aggregate pool and sell it on to industrial, commercial and residential customers. However, there are also customers who purchase electricity directly from the generators themselves. Distribution companies are also allowed to import electricity directly from neighbouring countries. The current transmission network connects Georgia to Turkey, Russia, Azerbaijan and Armenia.

The end user tariffs are set by the regulator by aggregating the generation tariff, the transmission tariff and other tertiary charges for dispatch and losses. The end user



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tariffs have increased significantly in recent years and are now on par with those in Western Europe.

Key Players

The main institutions in the energy sector are the Ministry of Energy, GNERC and wholesale operators

There are four main state institutions involved in the Georgian energy sector: The Ministry of Energy, The Georgian National Electricity Regulatory Commission (GNERC), The Georgian State Transmission Company and ESCO.

The Ministry of Energy is the main policymaker in the energy sector while GNERC is responsible for pricing and licensing functions. ESCO is a commercial operator which distributes power between market participants and leads the development of transparent payment schemes in the system. The Georgian State Transmission Company controls dispatch and transmission.

Generation

Most of the country's generation comes from hydropower, 70% of which is supplied by the 5 largest HPPs

Total installed generator capacity (thermal and hydropower) in Georgia is approximately 4,800 MW, but only about half of this capacity is in operable condition. The total hydroelectric capacity is 2,843 MW spread between 14 large scale plants and about 80 plants of less than 10 MW capacity each. In recent years, electricity has been generated almost entirely by hydroelectric facilities (81.4% on average since 2000), with the balance being generated by natural gas fired thermal power plants:

- 14 medium and large hydro power plants (HPP) with a capacity 5.6 TWh
- 3 thermal power plants (TPP) with an operating capacity of 2.2 TWh

Georgia is estimated to have the highest hydropower resources per capita in the world. However, currently no more than 18% of this capacity is used.

There are six stand-alone hydroelectric plants with the remaining plants grouped into five cascades. Of Georgia's hydroelectric plants, the five largest (Enguri, Vardnili, Lajanuri, Zhinvali and Khrami) account for 70% of the total production, while the biggest - Enguri (5 generators X 260 MW) - supplies about 35% of Georgia's domestic electricity.

The largest thermal plants in Georgia are the gas-fired Gardabani TPP, Mtkvari TPP, Tbilisi combined heat and power plant, and the Tkvarcheli coal-fired plant in Abkhazia.

Due to aging equipment in need of overhaul or replacement and a shortage of fuel supplies, the TPPs only operate at about 40% of capacity. Moreover, with the quadrupling in Russian gas prices to Georgia since 2005 to US\$235 per 1000 m³, thermal generation in Georgia is becoming more and more unprofitable and therefore renders itself increasingly vulnerable to being replaced by cheap hydro generation.

Transmission

Two electricity transmission licensees operate in Georgia. These include the Georgian State Electricity System Ltd (GSES), which owns the majority of transmission assets in the country, and JS Sakrusenergo, which owns an important 500 kV transmission line, known as 'Kavkasioni' (which originates in Russia and provides interconnectivity for many of the country's electricity transmission lines).

The management of GSES, the technical operator of dispatch and transmission systems, has been sub-contracted to the Irish company ESBI since 2002.

Distribution

Distribution is handled by six companies, which are mostly privately

Power distribution is sourced through the following companies):

- Telasi, owned by RAO UES, which serves Tbilisi - Georgia's capital
- United Electricity Distribution Company (UEDC) serves most of Georgia ex-Tbilisi



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owned

- ADC and KDC serve the Adjara and Kakheti regions, and the South-western and Eastern parts of the country, respectively
- Abkhazia and South Ossetia distribution companies serve their respective regions

Electricity distribution companies in Georgia are under private management, and technical and commercial losses in the system have been dramatically reduced in recent years to acceptable levels. As a result, the companies' profitability has been significantly increased and the distribution companies are now operating at a net profit.

Privatisation

In 1999, AES Corp acquired 75% of Telasi shares and assumed management of Telasi. It was subsequently resold to Russia's RAO UES in 2002.

The government announced the privatisation of six HPPs in Spring 2006, comprising a total capacity of 361.4 MW, and three distribution companies servicing more than 900,000 customers. The KDC (east Georgia distributor), was sold to the Georgian group TBC Energia for roughly US\$5 mln, 2.5-times over the reserve price of US\$2 mln.

The Czech company Energy-Pro bought 2 distribution companies and 6 generators in June 2006 for US\$417 mln

The rest of the companies were sold to the Czech company Energo-Pro in June 2006: UEDC and ADC distribution; and six hydropower plants in the Imereti region: Atshesi (16 MW, at Keda), Dzevruli (80 MW, at Terjola), Gumati I and II (76 MW, at Tskaltubo), Ladzhanuri (113 MW, at Tsageri), Rioni (48 MW, at Kurtasi), and Shaori (38 MW, at Tkibuli).

The agreement between Energo-Pro and the Georgian government anticipates US\$417 mln of investment from the Czech company, including: US\$132 mln, which Energo-Pro has already paid for energy assets; US\$85 mln, to be invested in the overhaul of Georgian hydropower plants over the next three years; and US\$15 mln in annual investment in the overhaul of Georgian distribution companies. In addition, Energo-Pro is planning to invest several million dollars in the construction of a 100 MW hydropower plant (or several small HPPs of a similar capacity).



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