



The new substation in Akhaltsikhe, the engine of the Black Sea project, features advanced HVDC back-to-back technology that is unique in the Caucasus.

Caucasus Crossroads

The Black Sea Transmission Network project allows Georgia to export green energy to Turkey. At the heart of the project is the only high-voltage direct-current (HVDC) station in the Caucasus region.

Text: Ingo Petz Photos: Fabian Weiss

There he stands: Kakha Kaladze, a man tall as a tree, with an impressively athletic figure and broad shoulders that are reminders of his former job. Kaladze, now aged 35, was a defender playing football for the glorious AC Milan – and the attackers of Manchester United, Chelsea, or Real Madrid had their work cut out trying to get past the Georgian player. With the Italian club, Kaladze won the UEFA Champions League twice. When he talks about his football career, he smiles shyly. His eyes fly around looking for something to get a grip on. They stop at a map on the wall in the brightly lit meeting room. It shows the Georgian electricity grid, which has undergone huge modernization in the past years. “Under President Eduard Shevardnadze, we had massive problems with constant power blackouts due to the bad quality and low stability of the old Soviet electricity net,” says Kaladze. “Moreover, our grid was not designed as a network for an independent state.

It was part of the power supply in the Caucasus that was linked to the neighboring Soviet republics. Building up a reliable power supply and grid for Georgia was an immense challenge and effort.” Kaladze is an ambitious sportsman who likes to confront new challenges. So he quit his football career in 2012 and went into politics, supporting the opposition party of billionaire Bidzina Ivanishvili, who won the elections in October 2012 to become the new prime minister. Ivanishvili appointed Kaladze as his deputy and Minister of Energy.

Energetic Country

With a population of 5 million people, Georgia is an energetic country, and it is not unusual for young Western-educated professionals to hold top jobs in business or in the government. The thriving dynamic determination of this country to keep pushing towards modernization, efficiency, and prosperity is symbolized by the huge building where

Kaladze’s office is located, right in the center of the capital Tbilisi and close to the Mtkvari River that flows through the city. With its mushroom-shaped roofs and glass-and-steel structure, the building (by Italian architects Massimiliano and Doriana Fuksas) has a science fiction appeal. The interior is dominated by space, glass, and curvy, airy forms. From the first floor, the busy sounds of keyboards, voices, and people moving around drift up to Kaladze’s office on the fourth floor. “The building hosts the central public service of the city,” explains an assistant of the minister who grew up in Berlin. “Here, you can get married or registered, you can register your car or your newborn child, or set up a company within a couple of hours.” Now Kaladze’s finger travels along the colored lines on the map showing the new power lines. He stops at the Turkish border in the southwest of the country. “Since 2011, Georgia has constructed around 300 kilometers of new ►



East-West bridge: Georgia and its capital Tbilisi occupy an important geostrategic position in the Black Sea-Caucasus region. In the long run, the country aims to export electricity to the EU via Turkey, which is applying for membership in the European Network of Transmission System Operators for Electricity (ENTSO-E).



The Akhaltsikhe HVDC substation operates on two back-to-back links, each line of which is able to transmit 350 megawatts of power; the station can connect unsynchronized power from the Georgian 500-kilovolt system to Turkey's 400-kilovolt standard.



power lines with transmission line towers. We have modernized substations in Gardabani and Zestafoni and built a new one in Akhaltsikhe, close to the Turkish border.” All this, he states – and now his soft voice becomes more confident – is part of the Black Sea Transmission Network. This project was started in 2010 with the support of the European Investment Bank, the European Bank for Reconstruction and Development, the German KfW Group, and the Development Bank of Austria, which put together the imposing sum of around €170 million. The strong international backing shows the substantial interest of the EU in the Caucasian country and its important historic and geostrategic location as a bridge between East and West.

Power Hub

Since 2010, Georgia has been exporting energy to all its neighboring countries. In 2011, the country generated approximately 11 terawatt-hours of

electricity. Of this, 1.3 terawatt-hours were exported. Georgia’s new hopes are based to a great extent on the demand for power in Turkey, which is increasing because of the thriving economy in the neighboring country. “Turkey is the main focus of our new energy export strategy in the current phase,” says the minister while walking over to his office, where flags of the EU and Georgia stand side by side. “Besides the famous Georgian wine, our country has a lot of water – around 300 rivers, which have the potential to generate 20 terawatt-hours annually. Therefore, we are developing hydropower stations across the country. Seventeen stations are currently being built, and another 62 are in the planning phase. Companies from Turkey, the USA, and India are investing in those projects. In spring and summer especially, our lakes and rivers are full of water. The energy surplus they generate will be exported.” In the long run, Georgia wants to

Georgia’s Minister of Energy Kakha Kaladze plays a key role in mapping out the country’s modernization drive.



export green electricity to EU countries via Turkey, which is in the process of applying for membership in the European Network of Transmission System Operators for Electricity (ENTSO-E). Earlier, while outlining the Black Sea Transmission Network project on the map, Kaladze had stated: “The new substation in Akhaltsikhe is the engine of the Black Sea project. Its modern HVDC back-to-back technology is unique in the Caucasus. In order to understand the significance of that place for our future, you have to go and visit it.” Traveling west on winding roads, one passes mountain villages, glittering blue lakes, and wide grassy plains. In the background, rocky hills and mountains reach out to the vast arching sky. Soviet-era electricity pylons stand out in this overwhelming landscape like old trees.

The “Miracle of Akhaltsikhe”

After four hours of driving, we reach Akhaltsikhe. The old city with its grand fortress is located close to the border with Turkey and Armenia. After we have gone around some more curves climbing up a slope, the substation with its towers, filters, synchronous condensers, converter transformers, and power lines appears like an alien spaceship. It occupies a vast plot of 30 hectares in total. “We had to move 1 million cubic meters of earth here, at approximately 1,100 meters above sea level,” explains Norbert Hilfert, the Project Director in charge of constructing the converter station. Siemens AG Germany handled construction together with sister company Siemens AG Austria, where Paul Kofler was responsible as Project Manager for the construction of the 500/400/220-kilovolt switchyards at Akhaltsikhe Substation. Work on the station started in February 2011. In May 2012 (first part) and November 2012 (second part), the substation was ready for testing. “Construction was completed very quickly. Some in Georgia even called our project the ‘Miracle of Akhaltsikhe,’ Hilfert jokes and takes a sip from his water bottle. The station is run by Energotrans, a subsidiary of Georgian State Electro-



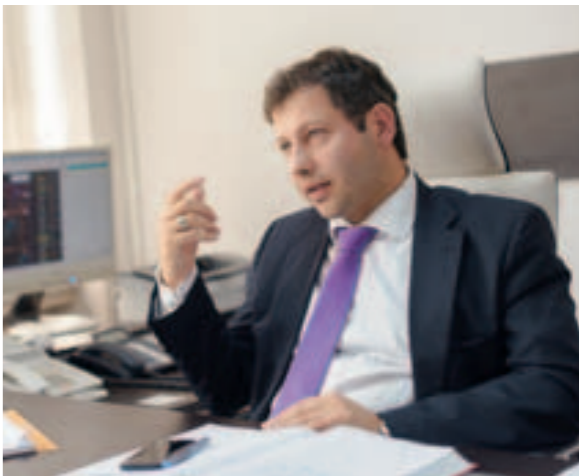
“Turkey is the main focus of our new energy export strategy in the current phase.”

Kakha Kaladze, Georgian Minister of Energy

system (GSE). In Tbilisi, GSE’s CEO Sulkhan Zumburidze also notes the importance of Akhaltsikhe. Talking about the Black Sea Transmission Network project, he leaves no doubt that Georgia is ready to become the center of power transmission in the Caucasus. “The idea for the project came up in 2008, when we met with people from the KfW Group bank. We told them: ‘We have no oil and gas. But we have water and we have a good geostrategic position. So we can generate power, export it, and function as a transmitter of power for other countries and companies in Europe.’ He pauses. “Thanks to Siemens, we now have a technological capability that no one else in the region can offer. ▶



The upgrading of Georgia’s Soviet-era electricity grid in recent years has been a huge challenge.



“We can function as a transmitter of power for other countries and companies in Europe.”

Sulkhan Zumburidze,
CEO, Georgian State Electrosystem

We will be the turnstile for transmitting and exporting power in the Caucasus.”
The sun is blazing as Hilfert walks towards the control center and the valve halls, where the actual power transmission takes place. With him is Akaki Nemsadze, one of the engineers at the station, where up to 18 people currently work; in the near future, it will offer employment for 26 staff. “Here we are on the Georgian side of the station,” the tall man explains. “Behind the central building is the Turkish side. Our network is based on a 500-kilovolt system. In Turkey and the EU, you have the 400-kilovolt grid. With the HVDC station, we are able to convert power from 500 to 400 kilovolt, and we can also convert 220 kilovolt into 500 kilovolt and back!” The station

The View from Turkey: Electricity Sales Power Good Neighborly Relations

Turkey has one of the world’s fastest-growing electricity markets. Due to its enormous demand, most of the neighboring countries are participants in the Turkish market. While Russia, Iran, and Iraq are significant suppliers of oil and gas to Turkey, Georgia is planning to sell electricity directly to its western neighbor in the near future. Only recently, Turkish Energy Minister Taner Yildiz reiterated that his country would soon need twice as much power as it currently does. Today, Turkey’s annual installed capacity is 57 gigawatts. The Ministry of Energy plans to generate 85 gigawatts a year by 2023 and to produce 120 gigawatts annually by 2050.

The lion’s share of electricity production will be based on conventional coal and gas plants. Siemens is currently building a top-of-the-line gas power plant in Samsun on the Black Sea. In order to reduce its dependency on imported oil and gas, Turkey will ramp up coal extraction and is also counting on use of nuclear energy. Currently, the government is in negotiations with investors from the United Arab Emirates and South Korea over development of one of the largest lignite deposits in Central Anatolia; according to reports, investments of up to US\$12 billion are at play.

On the other hand, development of renewable energy lags far behind. Although Turkey has large capacities for wind and solar power, there have only been minor investments in wind power recently – this spring, Germany’s E.ON and the Turkish Sabanci Holding opened a wind park in the Sea of Marmara – and almost none in solar energy.

With hydropower, it’s a different story: The major rivers in the country’s south and southeast are already being used to for power generation. In many

areas, the population is resisting the construction of still more dams and other encroachments on their rivers; therefore, the construction companies are seeking new investment opportunities abroad.

Turkish companies are already market leaders in hydropower construction for Georgia, and they aim to expand their activities there even further. After protracted negotiations, the Turkish government signed an agreement with Georgia in October 2010 that anticipates annual electricity imports of 150 megawatts. In June 2013, the head of Turkey’s energy market regulator EPDK, Hasan Köktas, stated that the necessary sections of the Black Sea Transmission Network project would be completed by the end of the year, facilitating electricity deliveries from Georgia to Turkey.

These electricity imports will either be handled by private companies – the Energo Pro company has already applied to the EPDK for a license for importing 15 megawatts – or be delivered directly to the Turkish national grid at peak periods when Turkey cannot cover its short-term needs itself. Such an exchange of electricity according to requirements – commonplace within the EU – already exists between Turkey and Bulgaria; upon completion of the grid, Georgia will also take part in this loop system.

While the share of Georgian electricity in meeting overall demand will be relatively small, it should be regarded as an important indicator of growing energy cooperation and market integration in the Black Sea region.

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In the control center of Akhaltsikhe station: In order to connect power grids that are not synchronized, the three-phase alternating current is converted into direct current and vice versa.



Besides converting and transmitting electricity, the HVDC station also enhances the stability of the Georgian grid by balancing out power disturbances.

operates on two back-to-back links, each link of which is able to transmit 350 megawatts of power. The line to Turkey is 34 kilometers long, ending at another substation on the Turkish side near the small city of Borçka.

The Heart of the System

Nemsadze and the others have reached the control building, passing by the huge transformers that weigh around 180 tonnes each. Two scruffy dogs are lounging in the shadows. Hilfert opens the door, and the group steps into one of the valve halls, which are locked by a special security mechanism: This is the heart of the system. Six thyristor valve towers hang like huge beehives in the dark building. Each of these two level towers holds a stack of 72 thyristors. Nemsadze points into the darkness. “Here, the three-phase alternating current is converted into direct current before

being transmitted to the inverter via a DC link. That’s where the conversion to three-phase current takes place.” The plant not only converts and transmits electricity. It also enhances the stability of the Georgian grid, balances out power disturbances, and acts as a firewall that can control, stop, or restart the transmission of electricity. It is obvious that Nemsadze, who was trained in Germany, is happy to have been chosen to work at the most modern substation in the Caucasus. “We already get a lot of visitors up here. Just recently, we had delegations from Russia and Azerbaijan. They are all interested in having their electricity converted and transmitted here.” In the future, the station’s capacity could be increased up to 1,000 megawatts. The sun is already setting, creating a spectacular display of colors against the mountainsides.

In the rear window of our car, the station slowly disappears as we head back down the slope. At the bottom of the hill we turn into the road back to Tbilisi. Above the hill, we catch a last glimpse of brilliance from the station’s floodlights that light up the darkening Georgian sky. ■

Ingo Petz has worked for more than 12 years as a freelancer covering eastern Europe for the most prestigious publications in the German-speaking world, including *Frankfurter Allgemeine Zeitung* and *Der Standard*. He has published several books and is also a regular contributor for academic journals such as *Osteuropa*.