

POWERING KENYA

UK firm Gilbert Gilkes and Gordon's connection with Kenya starts as far back as 1910 when they exported their first hydropower turbine to the country.

This relationship has stood the test of time and they continue to provide much needed sustainable power for the increasing power demand in rural communities.

Founded in 1856 Gilbert Gilkes & Gordon Ltd is a privately owned, internationally established manufacturing business based in the UK, delivering innovative, single source solutions to the Small Hydropower and High Horsepower Engine markets.

Today Gilkes Hydro offer single source solutions for a range of hydropower turbines, providing efficient, clean, renewable energy. With over 160 years of experience Gilkes water to wire solutions fit a range of hydropower applications. From large utilities to small mini grids, solutions are tailored to meet the needs of each individual project. The range of Francis, Turgo & Pelton Turbines cover medium to high head

projects capable of generating up to 30MW per unit.

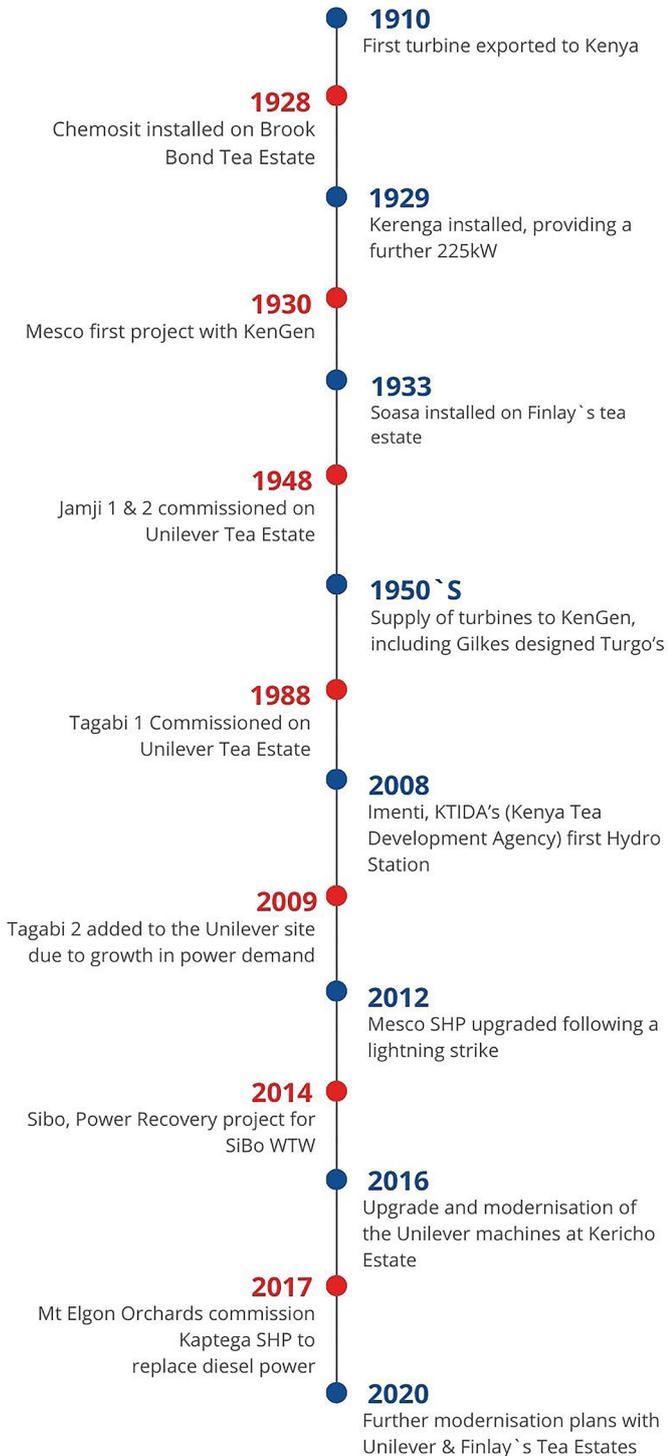
Small Hydro's roots in Kenya

From the first 19kW Francis turbine in 1910, Gilkes has since exported a total of 86 turbines to Kenya. Hydropower was one of the earliest recognised national resources dating back to early 1900s. The early systems were all small hydropower schemes comprising of micro hydros and mini hydros. Most of these power systems were used for maize milling, water pumping and in a few cases saw milling. Gilkes archives show the 1910 machine was purchased by a British farmer who farmed 5000 acres at Donyo Sabuk, near Thika from around 1904 and it is likely that the majority of these early turbines were installed for domestic use on farms.

Kenya's drainage system consists of five major basins: Lake Victoria, Rift Valley,



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Athi River, Tana River; and Ewaso Ng'iro River basins with bimodal rainfall ranging from 200mm-2000mm, during long rains in March-May, short rains October-December.

The total Potential for small, mini and micro-hydro systems in Kenya is estimated at 3000MW, with only 40MW currently developed.

Tea Estates

Later demand was driven by the tea estates and one of Gilkes longest standing relationships is with the Unilever tea estate (previously Brooke Bond). The Unilever tea plantation covers 8,700 hectares and employs 12,000 permanent workers. The plantation has produced tea since 1924. Hydropower has been in place at the property since 1928, with the installation of the first hydro scheme using a Gilkes turbine. The Chemosit scheme was a low head 100kW site operating off a head of 9m. This was closely followed by a 235kW, 16.5-inch Gilkes Francis Series II turbine in the Kerenga Power Plant. During this time Gilkes were also supplying equipment for hydro installations on other tea estates, including the neighbouring Finlays Tea Estate.

Kenya's largest electricity producer

In the 1930's Gilkes progression in the market led them to start working with Kenya Power Company, which later became Kenya's largest electricity producer, KenGen (founded in 1954). During the 1950's as KenGen focused on small hydropower as part of their energy strategy, Gilkes saw an influx of orders for their turbines. Among these machines were Turgo design Impulse turbines originally designed by Gilkes in 1919. It is testament to the longevity and unparalleled lifespan of hydropower turbines that these machines are still running today with little service and maintenance requirements.

In 2012 KenGen invited Gilkes to bid for the repair of the Mesco hydropower station after it was struck by lightning. The turbine was an original Gilkes machine installed in 1930 with a power output of 380kW. Gilkes were able to advise KenGen on changing the site from High Voltage to Low Voltage (415v) making it a lot safer. The output of the site was also increased by the installation of a newly designed runner, increasing the output by at least 10%. This work was the first major overhaul of the plant since its commissioning some 90 years earlier.

Increasing demand for power

The 1980's saw a requirement for higher output machines as the demand for power on the tea estates increased. One of these machines was an 800kW Francis machine installed for Unilever at the Tagabi power station on the Kericho tea estate.

Tagabi II power station would later be added to the Kericho Estate following the feasibility studies which were undertaken through the GTIEA (Green Tea Industry East Africa) project on various tea estates throughout Kenya. This was in partnership with the KTDA (Kenya Tea Development Agency) to provide cheaper electricity and reduce the reliance on diesel power. This resulted in the introduction of mini grid schemes which would run isolated from the main grid.

Modernisation

Gilkes turbines have an unparalleled life span. However, at some point during the life of a hydro scheme, there will undoubtedly come a time where plant modernisation will be required and certain aspects will have to be replaced, refurbished or upgraded.

In 2014 Gilkes worked with Unilever to upgrade 5 of the Turbines on the Kericho Estate. The project involved both a mechanical and electrical upgrade with the scope of work increasing the flexibility Unilever have in operating their hydro turbines. This assured a stable electricity supply even during utility outages using the load sharing capability of the digital governors.

New or rejuvenated electrical controls and mechanical equipment for utilities'

small hydro units and mini grids can have immediate benefits. This is particularly true in rural or isolated areas with less stable or limited power supply grids.

Modernisation can improve the overall efficiency of a scheme. Increased generation and reduced downtime can provide improved annual energy production due to higher reliability and lower operator dependence.

Andy Eaton, Head of Sales Africa, Gilkes Hydro: "It is a true testament to both Gilkes and Unilever how these schemes have stood the test of time. Initially the M&E equipment was biased towards mechanical making it easy for the local plant operators to carry out repairs. As technology has advanced over the years the shift has been towards the electrical package and making the schemes available for remote access and monitoring."

Present & Future Development

As there is a push for cleaner, greener energy, removing the requirement for diesel power, more industries are looking to small hydro as a more reliable and sustainable source of power generation.

Mount Elgon Orchards are among Gilkes most recent customers in Africa, with a remote farm based on the Kenya Uganda border. The opportunity to install a small hydro project on the farm allowed them to almost remove the use of diesel power. The recently commissioned hydro plant provides 70% of the farms annual needs, producing 249kW and saving the farm over 1,100 litres of diesel per day, previously in its diesel generators.

Access to electricity in Kenya is still low despite Government targets to increase connectivity to 65% by 2022. Hydropower currently makes up 30% of installed capacity, with electricity demand projected to grow. The contribution from small hydropower to the energy mix with the construction of small hydropower stations will provide affordable electricity to rural communities and support the Government's aim of 100per cent access to electricity.

Gilkes Look forward to continuing to support the Kenyan market for many years to come through new projects and continued partnerships with our existing customers throughout life of the schemes. ■

Andy Eaton, Head of Sales Africa, Gilkes Hydro: "Gilkes see Africa and Kenya as one of their key markets. We have a long history, with well-established customers who we have served for many years. Whilst we have an extensive history we are keen to move forward with the new type of developers. These are mainly private investors who see small hydro as a sustainable energy source and therefore an ideal investment opportunity. At Gilkes we plan to service our customers for the next 100 years, just as we have done successfully for the last 100 years!"

Gilkes have been supplying hydroelectric turbines to the African market for over 100 years and continue to be fully committed to working in Africa, in particular providing much needed rural electrification through mini grid systems.

KAPTEGA, MOUNT ELGON, KENYA

PROJECT SUMMARY

Gilkes engineers have recently completed commissioning of a 13.5" Twin Jet Turgo for the Kaptega scheme at Mount Elgon Orchards in Kenya. Mount Elgon Orchards Ltd is a remote farm based on the Kenya Uganda border, exporting 80 million Top quality roses around the world under the brand "The Elgon Collection" (www.mtelgon.com). It also grows 80 hectares of avocados currently. It is a family run farm and the largest employer in Trans Nzoia (Western Kenya) employing 1,400 permanent employees. Its CSR is impressive, with 3 schools (2,000 children), a hospital and VCT treating 40,000 patients annually, a children's home, a special needs home, a physiotherapy Centre and an orthopaedic workshop. The recently commissioned hydro plant produces 249kW and is saving the farm over 1,100 litres of diesel per day, previously in its diesel generators.

The electrical characteristics of the site were unusual and demanding, requiring black start ability, islanded running, and regular load changes of up to 50 kW. With the potential of a future grid connection, this scheme had to be engineered for changing needs.

Gilkes carried out an initial site survey and, with the key requirements identified, were able to offer a comprehensive hydro package. By including a flywheel on the generator, and coupling this to a Turgo Impulse Turbine, the load characteristics were accommodated and efficiency retained. The custom made control panel with battery backup enables true black start ability and islanded running now, whilst allowing parallel connection to a grid in the future. As with many Gilkes turbines, the powerhouse will be unmanned and require only routine inspection and maintenance.

KEY STATISTICS

Customer: Mount Elgon Orchards Ltd

Turbine Type: HCTI Twin Jet Turgo

Number of Turbines: 1

Power: 237 kW

Net Head: 82 m

Flow: 370 l/s

Runner Dia: 13.5"

Speed: 1000 rpm

SCOPE OF SUPPLY

Gilkes HCTI Twin Jet Turgo Impulse Turbine
 260 kVA Synchronous Generator with Flywheel
 Inlet Pipework & Bifurcation
 Main Inlet valve
 Hydraulic Control Module & Actuators
 Control Panel & Switchgear
 24V DC Battery Pack
 Installation & Commissioning

Over 1000 Turgo turbines have been delivered to world markets since being invented, by Gilkes, in 1919. With the inherent resilience to the abrasion of silt laden water, and the high efficiency maintained over a broader flow range, the Turgo turbine yields a competitive edge over the traditional Pelton in challenging environments. The simplicity of its impulse operation translates to minimal service and maintenance requirements, making it particularly suited to remote, rural, electrification schemes such as Kaptega.

Gilkes have been supplying hydroelectric turbines to Africa for over 100 years and continue to be fully committed to working in Africa, providing rural electrification through mini grid systems.



Powerhouse During Assembly



Turbine During Installation

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MESCO - KENYA, AFRICA

PROJECT SUMMARY

The client (Kengen) approached Gilkes to advise on the refurbishment of a hydro turbine that was installed in 1930. The system had been subjected to a lightning strike causing a fire within the powerhouse. The original turbine had been running well and still had its original runner. The turbine was an overshot machine with an aluminium-bronze runner. The turbine had a mechanical governor and generated 410kW at 3.3kV.

A project engineer was tasked with designing and modernising a new runner assembly and control system to bring the turbine into the 21st century. A site visit was conducted to determine the serviceability of the old equipment. A report was written and issued to the client and insurance company for acceptance.

Due to the size of the machine it was recommended that the voltage be reduced from 3.3kV to 415v. The result in reducing the voltage was a cost saving for the switchgear and generator. The original runner had an efficiency of 82% and was upgraded with a stainless steel assembly that produces 92% efficiency.

The control system now has an electronic governor that governs the machine via the hydraulic actuated guide vanes. It is now a fully automated system that manages the water level in the intake. One requirement from the client was that the new system is to be fully integrated into the existing Scada system. The commissioning engineer worked closely with the client to ensure all signals were fully integrated and the control system can be controlled remotely. ■

KEY STATISTICS

- Customer:** KenGen Ltd
- Net Head:** 37 metres
- Flow:** 1396 litres/sec
- Turbine type:** Gilkes Francis 518G190
- Number of Turbines:** 1
- Original Power (kW):** 410
- New Power (kW):** 456
- Dia:** 518mm
- Date of original Commission:** 1930
- Date of Order:** 2011
- Date of Commissioning:** July 2013
- Speed:** 750rpm
- Project Commissioned:** November 2013
- Scope of Supply:** 518G190 Horizontal GILKES Francis runner assembly, fitted with hydraulic actuator on the guide vanes. 510kVA – 415v – 750rpm Synchronous Generator; Draught tube pipework; Main Inlet Valve – DN600-PN10 Butterfly Valve; Hydraulic Control Module; Turbine Control Panel; 2000A rated 415V two section standalone switching panel.



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