More Revenue, Less Headaches for Mini Grid Improvements in Kenya

Nine hydropower units serve the Unilever Kericho Tea Estate in Kenya. Maintenance people must sit at the control panels for each of the generators every minute the units are operating — ready to frantically spin the hand wheels on the mechanical governors.

But this is no longer the situation for five of these units. Thanks to new control systems, these employees are free to perform regular maintenance on the plant without governor worries.

Upgrading controls

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 1929, with the installation of the first 235-kW, 16.5-inch Gilkes Francis Series II turbine in the Kerenga Power Plant. Since that time, four additional Gilbert Gilkes & Gordon units covered by this refurbishment were added to the mix. These five units had mechanical governors. Over time, the mechanical control equipment had degraded to the point that the security of the power supply was a big issue. Additionally, spare parts were increasingly difficult to obtain.

For the five units at the Kerenga hydro plant, governor control initially was achieved through manual operations.

After evaluation by the company and Gilkes engineers beginning in 2014, modernization of the five Francis turbine units was completed, with 2016 culminating with a full upgrade to digital governors. The project modernizations included new control panels, digital governors, hydraulic power units and hydraulic actuators. The five units now range in size from 235 kW to 852 kW, with a total generating capacity of 1,948 kW.

The new controls also provide a range of self-protection features, which allow data analysis when the units shut down. The new packages are fully automated and are intended to improve annual energy production and reduce downtime.

Before the upgrade, many of the units were only operable in parallel to a wider power network, and operation was very unreliable. Since the fix, the units now have the ability to be black-started. Additionally, the units can now operate independently of the national power grid and are interconnected with one another in a mini grid with the ability to load share on the estate. The plant's availability has risen significantly.

Data regarding operating parameters such as turbine speed and guide vane positions are shown in the operator interface and stored in the event of a system problem. Adjustments to resolve problems can be done locally or remotely to assure immediate assistance.

Plant owners enjoy about a 10% increase in power generated, higher plant availability, increased operating flexibility and a much more stable, round-the-clock, local area grid. The Gilkes commissioning engineer recently had the opportunity to revisit the project after one year of operation and reported, "I was very warmly welcomed by the operators and engineers. They were keen to tell me of how stable their network now is with the upgrade and the pride they have in operating the system.

After the control system upgrade, the units generate about 10% more power and have increased operating flexibility.

This was a rewarding project to be a part of and I see no reason for the units not to continue generating long into the future."

Conclusion

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. The integration of new or existing small hydro with local generation projects in mini grids provides increased power reliability and stability to those industries and communities, which often face increasing demand using aging or outdated technology.

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