

zenon helps to create a more efficient power grid in South Africa

Gert Sibande District Municipality minimizes power losses

The Govan Mbeki local municipality sits within the Gert Sibande District Municipality in South Africa's Mpumalanga Province. Following problems with its electricity supply, with high levels of technical and non-technical losses, the Gert Sibande district appointed Enpower Machite as its electricity service provider. Its work to upgrade the network and ensure a more reliable electricity service for local residents and businesses included the upgrading of vital infrastructure and systems and the deployment of a new control and monitoring system powered by COPA-DATA's zenon software platform.



POWER SUPPLY IN THE REGION OF GERT SIBANDE

Gert Sibande District Municipality is located in the southern part of Mpumalanga Province, bordered by South Africa's economic powerhouse, Gauteng Province, to the north; the KwaZulu-Natal Province to the south, and close to Eswatini (formerly Swaziland) in the east. The district is characterized by vast farming areas, mining activities, and power stations. It's also an economic hub for mining, manufacturing, agriculture, and tourism.

The district's grid network is primarily managed by Eskom, South Africa's national electricity public utility company. In 2021, the district municipality appointed Enpower Machite as the provider under a service level agreement (SLA). The local

municipality of The Govan Mbeki, which sits within the Gert Sibande District Municipality, had been experiencing very high technical and non-technical losses. Enpower Machite's appointment was aimed at addressing these grid challenges and ensuring a more reliable and safe power supply for residents and businesses, particularly in the areas of Bethal and eMzinoni.

IMPROVED LOAD-SHEDDING STRATEGIES ENABLE MORE RELIABLE SERVICE

Enpower Machite began by conducting network audits to identify areas needing improvement. They engaged with local communities to inform them about the work, which included actively replacing faulty transformers, conducting maintenance to ensure a stable electricity supply, and scoping and deploying



Operators can now see all networks in the Bethal Municipality, including recent events, alarms and trends.



SEL chose zenon as the control system because of its efficient and user-friendly engineering, configuration and testing.

an integrated utility operations software solution, including control and monitoring systems.

The need to optimize load-shedding strategies across the local network was a critical part of the improvement strategy. Load shedding is an important practice in efficient, reliable grid operation, but it often involves frequent switching, which can disrupt power supply and inconvenience customers. In the Bethal and eMzinoni districts, this meant some areas experienced unnecessary power cuts as a result of the lack of centralized control.

To prevent unnecessary switching and to develop optimized load-shedding strategies, Enpower Machite needed to gain real-time visibility and control over specific segments of the 11 kV and 22 kV networks.

A MODERN, INTEGRATED CONTROL AND MONITORING SOLUTION

In August 2022, Enpower Machite commissioned the first phase of a supervisory control and data acquisition (SCADA) system to improve grid monitoring and bring visibility to otherwise opaque sections of the network.

Supplied by Schweitzer Engineering Laboratories, Inc. (SEL), the solution delivers real-time visibility and control over specific sections of the existing network. It is based on the SEL Real-Time Automation Controller (RTAC) and the zenon software platform from Austrian industrial software specialist COPA-DATA.

Deon Naidoo, Engineering Services Manager at SEL, explains, “We chose COPA-DATA’s zenon software platform because the engineering, configuration, and testing are extremely efficient and user-friendly. zenon’s features,

scalability, drivers, and smart engineering approaches make these projects quick and efficient to complete.”

FASTER TIME TO VALUE WITH PHASED APPROACH

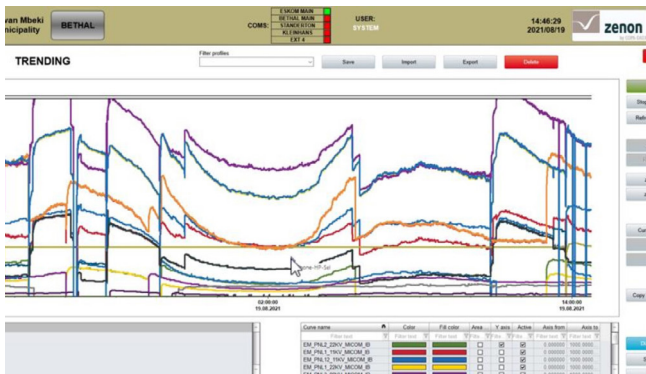
The initial phase of the project focused on Bethal’s main 11 kV substation and Eskom’s 22 kV incoming station. To keep costs to a minimum and ensure delivery of the necessary improvements within the limited budget, a “rip and replace” strategy was not feasible. Any improvement to the visibility of network performance would need to be cost-efficient and retrofitted to existing equipment. This was a strong motivation to choose zenon to deliver the SCADA capabilities, given the platform’s support for more than 300 native drivers and communication protocols.

SEL engineers designed the solution to allow older digital devices to connect to the SCADA system to serve data and perform controls, which minimized costs. Old serial communication (Modbus through copper) would be used until the budget allows the older relays to be replaced with SEL-851 Feeder Protection Relays.

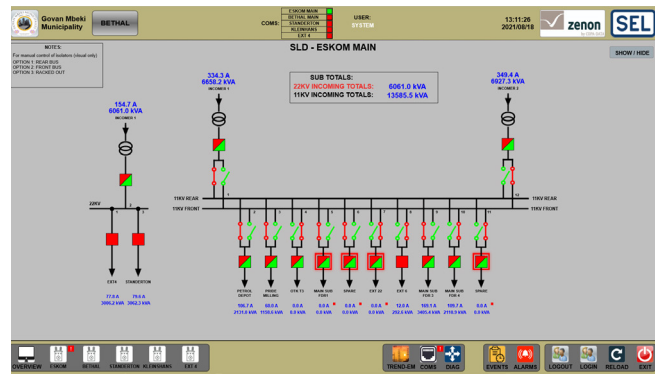
The zenon software platform’s modularity, flexibility, and exhaustive range of natively supported drivers makes system component replacement far easier.

OPERATORS GAIN CLEAR OVERSIGHT

Highly skilled SEL engineers performed the design, development, testing and commissioning of the solution. “Engineering in zenon is straightforward and highly efficient,” reports Paul Van Zyl, Project Engineer at SEL. “zenon’s extensive library of energy communication protocols allows for



The new centralized control system provides operators with essential reports, including trend analyses.



Clear line diagrams enable operators to immediately understand the status of all network components.

the integration of almost any OEM device. The smart features and functions in zenon make duplication work and engineering both easy and efficient. The software is user-friendly and easy to navigate, yet remains flexible and powerful enough for advanced functions.”

Paul Van Zyl continues, “Added to that, the support from COPA-DATA was exceptional from start to finish. Working with COPA-DATA makes everything seamless and effortless. We received quick support during commissioning, and it is an absolute pleasure to work with them. It’s reassuring to know that when executing a project, you can rely on getting the necessary support.”

A CONCISE OVERVIEW OF OPERATIONAL STATUS

The new zenon-based SCADA solution gives Enpower Machite a holistic, real-time overview of the network and its performance. Each substation was equipped with an SEL RTAC, which consolidates data from protection relays within the substation. Information is sent to the control room via Cambium Ethernet radios, giving operators clear oversight of data for control, alarm, and trend analytics purposes. These trend reports can be accessed locally in the control room or shared with Eskom for further analysis.

Paul Van Zyl explains, “Combining SEL’s highly powerful automation equipment and protective relays with zenon-powered HMIs, using communication protocols like DNP3 and IEC 61850, creates a robust yet user-friendly system that is easy to understand and navigate.”

The control room system makes use of zenon’s built-in redundancy capabilities for reliable performance and assured data integrity. Each substation has a dedicated single line diagram from which operators can navigate, with detailed bay

views for specific breakers and a communication monitoring page to track communication failures and ensure a timely response to issues.

Rudolf Evert, Technical Chief Engineer at Enpower Machite, emphasizes, “For the first time in the existence of Bethal’s electrical network, network operators could see the status of the network and action controls from a single point: the new control room. Previously, operators had to drive to specific substations in the network to get network information and perform switching. The new system makes the entire operation of the network more efficient, much quicker, and has almost eliminated safety concerns during switching.”

UPGRADING THE GRID TO MINIMIZE LOSSES

Operators now have real-time insights into the network status, enabling better decision making. Analog meter quantities are recorded and operators can see historical trend analyses of these and other key metrics. For improved operation, the system provides alarms when predetermined thresholds are met or other network performance signals are recorded. This includes information like overloading, circuit breaker statuses, protection trip notifications, and more. Remote breaker circuit controls enable the necessary commuting and switching functions.

By precisely monitoring load distribution across the network, Enpower Machite system operators can make informed decisions about the optimization of load-shedding strategies, which improves network performance, minimizes losses, and enhances service to customers.

Rhulani Matshidze, CEO at Enpower Machite, explains, “The network can now be monitored and controlled live and

“The network can now be monitored and controlled live and on a 24-hour basis. As a result, overall network performance has increased significantly.”

RHULANI MATSHIDZE, CEO, ENPOWER MACHITE

on a 24-hour basis. As a result, overall network performance has increased significantly. Importantly, operational costs have decreased because considerably fewer man-hours are now required for day-to-day operations since operators do not have to drive to substations to monitor and control.

“Further, our new ability to remotely action pro-active network switching prevents tripping due to overload,” Rhulani Matshidze continues. “This reduces the risk of equipment failure, unplanned maintenance, and repairs. Due to the increased grid availability, revenue through electricity sales has also increased.”

BUILDING ON SUCCESS: THE NEXT PHASE IS UNDERWAY

The implementation of this relatively inexpensive SCADA system has significantly improved the electrical supply to Bethal residents. It is a crucial step toward minimizing the effects of load shedding, ensuring a more reliable electricity supply, and benefitting the entire community.

Deon Naidoo emphasizes, “Creating and designing these systems is a life-changing experience, as they make a real impact on people’s lives. We adhere to our SEL values of customer focus, ownership, communication, quality, and community which guide us in all customer interactions and project executions and have been crucial to the success of this project.”

Enpower Machite is already working with SEL to drive forward phase two of the upgrade and improvement project. The SEL-851 protection relays have replaced existing electromechanical protection relays in each substation. Data from the SEL RTAC now transmits to the central control center via Ethernet wireless communication radios.

These advanced relays offer comprehensive protection elements to safeguard equipment against various faults. Remote control capabilities via zenon’s intuitive user interface

will enable operators at the control center to issue close and open commands during load-shedding schedules.

Deon Naidoo concludes, “Just as SEL strives to develop cutting-edge technology to solve complex problems, I believe COPA-DATA shares this vision, making our collaboration productive and rewarding. Our common goal is to deliver cost-effective, professional, and high-quality solutions that meet our customers’ demands and solve their problems.”

HIGHLIGHTS:

- ▶ Cost-effective SCADA solution improves reliability of electricity supply for residents.
- ▶ Retrofit project uses existing equipment and can be upgraded as budgets allow.
- ▶ A holistic, real-time overview of network performance empowers improved decision-making.
- ▶ Upgrades offer new visibility of 11 kV substations and 22 kV incoming station.
- ▶ Each substation can now be visualized in dedicated single line diagrams, communication monitoring pages, trending pages, and reports.
- ▶ System allows operators to drill down into detailed bay views of selected breakers.
- ▶ System presents analog meter values, alarms, trend reports, and remote circuit breaker control.
- ▶ Improved visibility and decision-making enables better load-shedding strategies and minimizes losses.