G&W Electric

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CASE STUDY

CLiP®-Current Limiting Protector

Decades of reliable success in Latin America with the CLiP® Current Limiting Protector

Decades of reliable success in Latin America with the CLiP® Current Limiting Protector

Pedra Agroindustrial S/A, a Brazil-based renewable energy company, has been operating since 1931 planting and harvesting sugarcane. With four production facilities located in the states of São Paulo and Mato Grosso do Sul, the company produces ethanol, sugar and electricity from the processing of sugarcane. This process includes the burning of bagasse, a byproduct of sugarcane, for cogeneration.

The opportunity: Leveraging waste for a sustainable future

A decade ago, Pedra Agroindustrial identified a significant opportunity to leverage the waste product from its sugarcane production to generate energy—and this strategic move allowed the company to enter the renewable energy sector. Its mission is now to become a leading provider in the sugar-energy sector while focusing on environmental sustainability and contributing to the economic, social and environmental development of the communities in which it operates.

Implementation and partnership: Two new power plants

Pedra Agroindustrial collaborated with its long-time partner and technical solutions consultant, Siner®, in the commissioning of two power plants specifically designed to produce electricity from sugarcane processing.

The challenge: Three power plant upgrade options

During the planning and design of the two power plants, it was determined that the plants could not interconnect due to the level of fault current. As energy was transferred to the utility, the connection to the grid caused the equipment to be underrated.

There were three possible solutions: upgrade their equipment to a higher fault current rating or utilize either a current limiting reactor (CLR) or a current limiting protector (CLiP®). Here is what each of those options would offer:

I. **Upgrading the equipment:** This came with significant cost concerns. A primary obstacle in the Latin American market at the time, especially in Brazil, was the availability of equipment rated higher than 40kA. Brazil lacked domestic production for higher-rated equipment, necessitating importation, which drove the cost much higher. In addition, the higher cost continues to increase exponentially for equipment over 40kA because it requires customization, specialized labor and import taxes.

II. **Current limiting reactor (CLR):** This is a traditional solution, and presented initial cost savings and ease of installation while also allowing for no downtime when a fault happens. However, there was a concern of a CLR causing voltage regulation and power efficiency issues. In addition, it was more costly over the life of the equipment, took up more space and would incur higher maintenance costs and require yearly testing to ensure proper functionality. This lead Pedra Agroindustrial to seek an alternative solution.

III. **Current limiting protector (CLiP):** The CLiP current limiting protector offered long-term cost savings, a compact footprint and enhanced safety, as well as other key advantages. Installing a CLiP current limiting protector would allow Pedra Agroindustrial to protect their system once it was interconnected and allow for safe operations while saving on costs and realizing greater ROI.

Ultimately, the decision was made to use G&W Electric's CLiP current limiting protector for the power plants.

The solution: G&W Electric CLiP current limiting protector

The CLiP current limiting protector is an electronically sensed and triggered, commutating form of current limiter protection using a copper busbar path that carries the continuous current. The CLiP current limiting protector limits blast and arc flash exposure, mitigates fire, reduces magnitude of peak let-through current and shields overdutied equipment from damage and catastrophic failure.

For Pedra Agroindustrial, the solution made it possible for the system to be interconnected with the 13.8kV to 138kV system by resolving overdutied equipment issues. Since the rating for the equipment was 40kA, if the available fault current goes above that, the CLiP current limiting protector steps in to protect the system and cut off the fault current immediately so it doesn't experience the full force of the fault. This saves the equipment from being severely damaged and protects personnel from catastrophic injury.

The results: Long-term reliability and cost savings

Pedra Agroindustrial found that the CliP current limiting protector solution was easy and cost-effective to maintain while being incredibly reliable. Here are a few benefits they realized after implementation:

Over the span of 20 years, using the CLIP current limiting protector is estated to save the chemical plant over $600,000.

Total cost of ownership (TCO) was ultimately lower than a reactor solution.

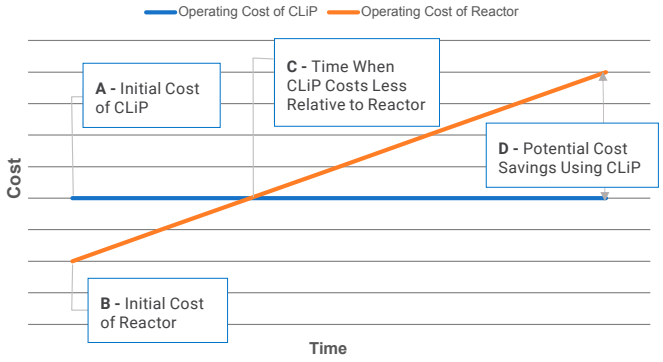
Massively reduced capital costs and increased ROI were achieved without the need to upgrade the equipment or utilize other devices with higher long-term costs, such as reactors.

The CLiP current limiting protector only requires field testing once every three years, so maintenance costs remain low to ensure the system is functioning properly.

The CLiP current limiting protector has a long-term lifespan—only needing to be replaced every 20+ years.

> We are extremely happy with our decision to utilize the CLiP current limiting protector in our plant design. The CLiP current limiting protector has proven to be a highly reliable solution with decades of success in the market to stand behind.

Operating Cost of CLiP vs Reactor Over Time



How CLiP current limiting protector works

Upon occurrence of a short circuit current:

I. A sensing unit actuates a contained pyrotechnic operation based on a predetermined trigger setting.

II. The copper conductor is segmented in several fractional lengths and bends them upward, forming multiple gaps.

III. Arcs form at these gaps and the resultant arc voltage causes transfer of the short circuit current to a parallel current limiting fuse.

IV. The fuse melts and clears the circuit fault.

V. Current extinction occurs in the first half cycle and limitation prior to the first peak.

VI. Reliable interruption is assured without venting of ionized gases.

VII. All of these steps happen from one quarter to one half cycle. Nothing else is so fast to protect the assets.

CONTACT US
305 West Crossroads Pkwy
Bolingbrook, IL 60440 USA
Phone: 708.388.5010 | Fax: 708.388.0755

www.gwelectric.com

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