



## Benefits of ETAP Intelligent Load Shedding

Industrial and Cogeneration plants are constantly operating at peak efficiency and manufacturing everyday use products. Despite the diversity in products manufactured, they have one thing in common: they consume significant amount of electricity in order to maintain a targeted production rate and net profitability.

In a perfect world a reliable and high quality supply of power would be available to guarantee successful operation, profitability, safety, and environmental preservation. Often this is not the case and electrical systems are subjected to disturbances of various magnitudes and various locations. These disturbances either cause minor interruption in the production process with production cost going up \$100,000 per incident or they may linger long enough to cause a more severe outage that has a substantial impact on revenue in the tune of millions of dollars per incident.

For example, an electrical fault or disturbance can be a major cost in the copper production process. A short electrical disturbance in open pit copper mining may cause production losses in the range of \$50,000 to \$100,000 per hour. To restart a large electrical load, for example a copper floating concentrator, will take longer than 30 minutes and will cause production losses of tens of thousands of dollars.

Managers understand this correlation between an unpredictable electrical system and its impact on profitability. From bitter experience designers realized, sometimes a combined power supply that includes on-site generation in addition to an electric utility grid is necessary to improve the reliability of their system. However in most cases this additional onsite generation is supplemental and not capable of independently supporting the entire industrial process at the same time maintaining the system stability during a disturbance. When system stability is challenged due to a disturbance, all critical loads should be preserved and intelligent load shedding systems have to be implemented that have the same understanding of the electrical network as the engineer who designed and analyzed them.

This article describes the success of one mining company who are proactively managing 110 MW of system load using ETAP Intelligent Load Shedding (ILS). This cyclic load is carried by four steam generators and eight emergency/spinning reserve diesel generators.

In addition to functions such as Advanced Monitoring and Load Trending, ETAP ILS provides optimal load shedding for demand side management and response, mechanical disturbances such as boiler trips, and electrical disturbances such as faults. ETAP ILS provides them faster execution of load shedding, as compared to conventional systems thus further reducing the load relief requirements in this mining company.



The ETAP ILS system was designed to provide the following main benefits:

- **Optimize load preservation** – The critical loads in a mining company include the mills involved in unearthing process as well as the motors that cool them. Some of these machines like example sag mills can be as large as 12,000 HP and are the backbone of the entire process. Due to disturbances at the supply, if these machines are shed, it typically takes 24 hours to bring them back in operation. ETAP ILS monitors the entire system collectively and knows the status of every individual load and the amount of loading. ETAP ILS uses this knowledge to reprioritize the load shedding list dynamically such that all critical loads in the mining company are being preserved under foreseen or unforeseen circumstances with an estimated saving of at least \$500,000/day.
- **Eliminate unnecessary load shedding** – In this mining company the relays operated with a 2 second delay after the disturbance. The amount of load that is shed is proportional to this delay time. With the help of multi-threading technology ETAP ILS determines, simultaneously and instantaneously, optimal amount of load to shed under various possible disturbances. Using intelligent grouping and sorting techniques, ETAP ILS determines exactly how much load needs to be shed and what combination of loads would help it reach that target in order to maintain system stability. The result is load shedding in <80 ms from the initiation of the disturbance. Hence improving reliability and availability of the process.
- **Reduction of spinning reserve requirements** – With most conventional systems, the amount of load being shed and speed is not controllable. Hence some operating reserve made up of spinning and sometimes non-spinning reserve needs to be made available. A spinning reserve policy determines the amount of extra capacity of dispatched generation over and above the load requirement at any given point in time. By providing a faster and intelligent control of the loads being shed, the required spinning reserve demand was reduced tremendously. By reducing the amount of required spinning reserve, the savings on the fuel cost and maintenance for these diesel generators paid for ETAP ILS in the first year alone.
- **Reliable load preservation system** – ETAP ILS scans the system periodically for signs of disturbance and in some cases potential disturbance such as a trip on the pulverizer that crushes the coal for the steam generator. After a pulverizer trip, the coal feed into the combustion chamber will be reduced and eventually will result in a drop on the steam pressure and final electrical output. ETAP ILS does not wait for the system to reach that stage and instantaneously knows how much load shed needs to be done to prevent mechanical stress on generators and the rest of the system. ETAP ILS is trained to think and it always double-checks to make sure the disturbance signal it is receiving is in fact true and not a nuisance signal. With multiple redundant units available, ETAP ILS is the safest and reliable method for load shedding.
- **Fast response to electrical & mechanical disturbances**  
< 80 ms from the detection of the disturbance
- **Robust calculation method**  
Simultaneous calculations, validated calculations



- **Operator alerts for marginal operating conditions**
  - under steady state condition when the mining company system sees overload condition and if overload coincides with peak demand charge period, ETAP ILS Alerter notifies operator about the approaching peak charge. If condition is not acknowledged and corrected then ETAP ILS will initiate load shedding automatically. ETAP ILS can be setup to incrementally restore these loads automatically after a certain time period.
  
- **Offline test and validation of load shedding response**
  - Mining company tested various scenarios upfront before deploying
  - Open system so they can add new possible disturbances and let the program determine optimal shedable load and verify results